Identification of critical habitats and conservation issues for the Western Rattlesnake and Great Basin Gopher Snake within the Thompson-Nicola region of British Columbia

FINAL REPORT
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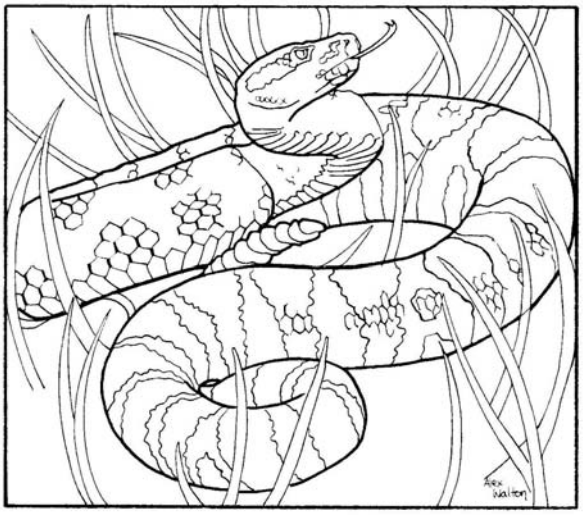

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(incorporates and replaces Year 1 Summary Report)

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EXECUTIVE SUMMARY

THOMPSON-NICOLA RATTLESNAKE & GOPHER SNAKE PROJECT

The Western Rattlesnake (*Crotalus viridus*) and Great Basin Gopher Snake (*Pituophis catenifer deserticola*) have a restricted range in British Columbia and therefore are considered vulnerable or sensitive to certain human activities. Consequently, both snakes have been assigned to the 'blue-list' and have a provincial conservation rank of S3. Globally, these snakes are considered secure ('G5')

In the spring of 1999, we initiated a two-year study that examined the distribution and habitat of the Western Rattlesnake and the Great Basin Gopher Snake within the Thompson-Nicola region of British Columbia. The objectives of the study were to:

- increase public education and awareness of these two snake species;
- determine the distribution of the Rattlesnake and Gopher snake within the Thompson / Nicola study area;
- use radio-telemetry to identify critical habitats, particularly communal hibernacula.

Most of our work was focused in the areas immediately surrounding Kamloops, although some scouting was done in the Ashcroft/Cache Creek and Spences Bridge areas. The Kamloops area was the focus of the study because 1) time and budget constraints made it impractical to survey the entire area, and 2) Kamloops contains the largest human population within the study area so habitat loss in this area is relatively high, making work in the area relatively more critical.

Contact with the public was accomplished primarily through door-to-door canvasing, and numerous newspaper, radio and television stories on our study and the conservation issues facing these two species of snakes. Through these initiatives, we solicited information on snake sightings, both historical and current. Although this information was somewhat useful, we found that confusion between snake species was common, and that without verification, the reliability of most publics reports was weak. Overall, we believe this work was worthwhile in that it raised the public's awareness of the conservation issues surrounding these animals, at least in the short-term. It is clear, though, that both gopher snakes and rattlesnakes continue to be unnecessarily killed by humans out of fear and ignorance.

We radio-tracked rattlesnakes and gopher snakes to obtain detailed information on movements, habitat use, and the location of hibernating sites (hibernacula). All told, we were able to follow a total of fourteen animals until autumn, when they entered hibernation. In total we confirmed the location of fourteen hibernacula and another three probable hibernacula also were identified. In the following spring, we visited the hibernating sites to obtain some estimates of the relative size of the denning populations. Generally speaking, rattlesnake hibernacula relatively close to the city of Kamloops appeared to have fewer individual snakes. We believe this trend likely is due to persecution by humans and an increased probability of roadkill.

Although gopher snakes were reported fairly often by members of the public, our data indicate that large numbers of these sightings likely are due to misidentifications of the Western Terrestrial Garter Snake. In 1999 we encountered very few gopher snakes during our searches in the field (one gopher snake per 120 person-hours), and none were large enough to be implanted with radio transmitters. Building on what we learned in the previous field season, we located a total of 12 gopher snakes in 2000, and were able to implant three with radio transmitters. The gopher snakes we tracked commonly were found in or near rodent holes, most often in open sagebrush grasslands where cover objects are not abundant. Several road-killed specimens were collected and two were actually captured while crossing and/or basking on roads, indicating that gopher snakes are vulnerable to road-kill. Two of the three gopher snakes with radio transmitters hibernated in small holes found in open, flat areas. One of these two locations was monitored in the spring, no other snakes were observed at the site and emergence of the gopher snake believed to be hibernating at the location was not observed.

Rattlesnakes also were reasonably difficult to locate (one rattlesnake observation per 11.2 person-hours spent searching). Our inventory work along with the radio-tracking data showed that during summer, rattlesnakes nearly were always associated with cover objects such as boulders, crevices, or anthropogenic structures such as concrete berms or construction rubble. Three of our animals lived on the shoulders of roads for part of the summer, possibly due to the presence of these anthropogenic cover objects. Although they were not killed on the road, one was killed by a small tractor immediately next to the road. The fact that they were attracted to these structures suggests that care should be taken to avoid unintentionally encouraging snakes to reside near roads and other sites of human activity. All of the rattlesnakes hibernated in rocky slopes that were located above or adjacent to the area where they had spent the summer.

Based on our results and experience from this study, we make the following ten recommendations:

- rattlesnakes in this region are not in <u>immediate</u> danger of extirpation, but their 'blue-list' status ('vulnerable') should be maintained because of the on-going loss of habitat (particularly low-lying grasslands), and past and present persecution of the animals by humans;

- compared to rattlesnakes, it is very difficult to comment on the status of gopher snakes, due to their different behaviour and life-history, and the fact that confusion with the Western Terrestrial Garter Snake makes public sightings and reports unreliable as a form of inventory. In the absence of better knowledge, these species should remain 'blue-listed'.

- rattlesnake hibernacula in the region is typical of that reported elsewhere (rocky, south-facing outcrops and fissures);

- we found no evidence of communal gopher snake hibernacula; this adds to the difficulty in monitoring populations of this snake.

- cover-objects in the grasslands are important to these animals, particularly rattlesnakes; to ensure the viability of the two species such objects need to be maintained and if necessary managed in the grasslands.

- developers and managers must realize that a reliable inventory of these animals will take time and money. Short-term 'visits' are not sufficient to clarify the importance of an area to snakes;

- an on-going education program (i.e. akin to 'Bear Aware') is needed in this area (and likely in other areas such as the Okanagan), in order to raise awareness of the animals and to avoid needless killing of all species of snakes;

- anthropogenic cover objects are drawing snakes into contact with humans, usually to the detriment of the snakes; again, improved awareness of this problem can help mitigate the circumstances;

- snake-proof fences should be considered around human development, especially in areas that encroach on rattlesnake habitat;

- a long-term monitoring program for both snakes is needed; for rattlesnakes, this program could focus on the monitoring of hibernating populations, but for gopher snakes, the situation will be relatively more difficult to solve.

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Research permits for this work were granted by the Ministry of Environment, Parks and Lands (now Water , Land and Air Protection), BC Parks, the City of Kamloops, the Committee on Research Ethics (Animal Subjects) at the University College of the Cariboo. The Kamloops Indian Band granted us permission to work on their land. Thanks to the British Columbia Conservation Foundation in Kamloops for their role in administering this project.

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Assistance in the field was enthusiastically provided by Stephanie Chaput, Lita Gomez, Diane Haughland and Christopher Thevarge. Special thanks to Andy Raniseth, Bill Gilroy and Ramona Halota for donating their time to the field searches, and to Bob Davis for sharing his knowledge of snake distributions in the Nicola region.

We also wish to thank the many organizations, radio and television stations and newspaper publishers that provided free and much-needed exposure and publicity for the project. Finally, we thank the large number of people in the Thompson/Nicola region who took the time to convey to us their past and current sightings of snakes.

1.0 INTRODUCTION

The Western Rattlesnake (*Crotalus viridis*) and Great Basin Gopher Snake (*Pituophis catenifer*) are assigned to the 'blue-list' in the province of British Columbia. Through funding provided by the Habitat Conservation Trust Fund (HCTF) and Forest Renewal British Columbia (FRBC) we studied these two species of snakes within the grasslands and dry forests of the Thompson-Nicola region of BC. **This report summarizes and discusses the data that we collected during this study (May 1999 - May 2001), and it incorporates and replaces the Year 1 Summary Report written in April 2000.**

The goals of the study were to:

- confirm rattlesnake and gopher snake presence and/or relative abundance across as much of the study area as possible
- collect data on the general types of habitat that these snakes use during the active season
- identify critical habitats such as hibernacula, rookeries and egg-laying sites
- increase public education and awareness about the status and ecology of the Western Rattlesnake and Great Basin Gopher Snake populations in this region of BC

To meet these goals, we implemented a work plan that consisted of **(1) educating the public and collecting snake sighting data, (2) conducting inventory searches for rattlesnakes and gopher snakes, and (3) using radio-telemetry to intensively follow a number of individual snakes.** During the initial year of our study, we concentrated on the area surrounding Kamloops, because this represented the largest population centre in the study region, and thus the area where conservation problems may be most likely to occur. In the second field season, we again collected data from several areas near Kamloops but also used the information gathered in 1999 to expand our work to other areas.

We used field searches to detect snakes within specific areas, and to locate individual snakes suitable for telemetry. Because the study area encompassed a large amount of potential snake habitat, we were forced to target a smaller subset of areas. In general, we investigated areas that were (1) readily accessible, (2) likely to be impacted by increased human activity and/or development, and (3) remote but also likely to support snakes, given reports filed from the area. Areas that were readily accessible often were searched only once or twice. Telemetry was used in many of these sites to locate hibernacula, thus providing data that will be critical to future land-use planning.

2.0 STUDY AREA

The study area was located within the Kamloops Forest Region and included the grassland and dry forest habitats of the Thompson valley (Spences Bridge north to Cache Creek, then east to Monte Creek) and Nicola Valley (Merritt west to Spences Bridge). The study focused on the Bunchgrass and Ponderosa Pine Biogeoclimatic subzones within the Thompson Basin and Southern Thompson Upland Ecosections (see Map, page 43).

3.0 METHODOLOGY

3.1 Public Outreach

In order to raise public awareness about rattlesnakes and gopher snakes and to get information on snake sightings from the public we used several different approaches. We developed and distributed a "snake awareness" pamphlet (Table 1, Appendix 1) . Housing developments in areas that interfaced with rattlesnake and gopher snake habitat were targeted for pamphlet distribution. During door-to-door canvases, pamphlets were left in mail boxes, and short discussions were held with residents who were home. In addition, pamphlets were distributed to elementary schools, golf courses and various organizations and businesses (Table 1). The pamphlet was designed to educate the public about the study, the protected status of the snakes, their ecology and key features for identification[*]. People were encouraged to use the pamphlet to help them identify snakes before calling the hotline, where their sighting information was recorded (Table 2). We also established a 'snake 1-800 hotline' phone number to encourage people to call with snake sightings; this number was included in both the pamphlet and media coverage.

The media was used to reach a wide number of people. (Table 3 & Appendix 2). Kamloops television, radio and newspapers (Table 3) played a significant role in informing the public about the project, its purpose, the support of HCTF and FRBC, and a request for rattlesnake and gopher snake sightings. In 1999 both Kamloops newspapers ran stories that provided general information about the snakes and the study (Appendix 2). Two television spots on the local newscast, one in June and one in October, also helped to create public interest and spread information about what the study was aiming to achieve and why. Finally, one of the Kamloops radio stations included information about the project in several of their hourly newscasts. During the summer of 2000, the Kamloops Daily News included the project as part of a week long special report discussing the local grassland ecosystem and the Ashcroft/Cache Creek Journal published an article about the project in general. The snake hotline number was included in most of the media coverage and many calls were received as a result.

On a national scale, the project was filmed by the Discovery Channel, which aired a 15 minute segment in February 2001, on their 'Animal Tracks' program.

Educational presentations and mass E-mail (MOELP, MOF, BC Parks, research community) also were used to distribute the snake hotline number and inform people about the project, its objectives and the snakes in general.

[*] in 1999, we also included a request for badger sightings in the pamphlet, as support for another HCTF project in the Kamloops area

Table 1: Summary of Pamphlet and Poster Distribution

PAMPHLETS	
Kamloops Elementary Schools	3951
Kamloops Mobile Home Parks	140
Kamloops Residences, Farms and Businesses *including golf courses and key organizations	1004
Ashcroft/Cache Creek Residences, Farms etc.	600
Ashcroft Elementary	225
Walhachin	47
Total Number of Pamphlets Distributed	**5967**

POSTERS	
Kamloops	38
Ashcroft/Cache Creek	13
Savona	1
Total Number of Posters	**54**

Table 2: Hotline Summary and Reliability of Caller Species Identification

Snake Species	Total Calls	**Reliable Identifications**	Live Sightings	Captures	Killed	Roadkill	Responded
Rattlesnake	64	**17**	29	2	1	3	10
Gopher snake	78	**12**	25	4	2	6	10
Racer	10	**1**	9	0	0	0	1
Western Terrestrial Garter snake	13	**4**	6	3	1	2	2
Common Garter snake	2	**0**	0	1	0	0	1
Rubber Boa	6	**0**	6	0	0	0	0
unidentified species	11	**0**	9	0	0	0	0
TOTAL	**184**	**33**	**84**	**10**	**4**	**11**	**24**

Table 3: Media Coverage

ORIGIN	DATE	TIME
Newspaper		
The Kamloops Daily News The Daily News Extra Kamloops This Week	Friday, May 21, 1999 Tuesday, May 25, 1999 Sunday, May 23, 1999	N/A N/A N/A
The Kamloops Daily News		N/A
The Ashcroft/Cache Creek Journal	Tuesday, August 15, 2000	N/A
The Kamloops Messenger	Spring 2001	N/A
Television		
CFJC TV 7 - Interior Midday - Evening News - Late Night News - Weekend Midday	Friday, June 4, 1999 " " " " " " Sunday, June 6, 1999	1:00 PM 5:00 PM 11:00 PM 1:00 PM
CFJC TV 7 - Evening News - Late Night News	Friday, October 1, 1999 " " "	5:00 PM 11:00 PM
Discovery Channel – Animal Tracks	Thursday, March 8, 2000	5:00 PM 8:00 PM 11:00 PM
Radio		
Radio NL (AM 690)	June 1999	

3.2 Field Searches

Field searches were conducted in order to: (1) investigate/confirm sighting reports by the public, (2) attempt to verify presence of either/both species in certain areas and (3) locate gopher snakes and rattlesnakes suitable for transmitter implantation [Section 3.3].

Field searches (Table 4) took place from May to August, with most of the searches being conducted towards the latter part of the summer. The timing of searching was due to two main factors. Firstly, our efforts in May and June were focused on public education, and secondly, the warmer, drier conditions in July are thought to be optimum for finding snakes out in the open [pers. observ. KL and Pat Gregory (Univ. Victoria)].

We selected areas for searching according to several factors:

(1) reports of snake sightings: reports were used to prioritize certain areas according to the potential for target snake species presence in that area.

(2) suitability of the habitat: areas with sighting data were subjectively ranked according to either the presence or absence of certain habitat features (i.e. rock outcroppings, south facing slopes).

(3) proximity of the area to human development and activities: areas where human use of the habitat was high and/or had the potential to be high in the future were given priority for searching.

While searching for snakes, we collected data on the prevailing weather conditions and features of the search area itself. A habitat data form was created (Appendix 3) using the Resources Inventory Committee 'Wildlife Sighting Form' and its associated code lists (MOELP, 1998) as references. This form was completed whenever a snake was located.

Snakes generally were captured using commercial snake tongs, although non-venomous snakes also were captured by hand. All snakes captured during the project were marked and measured using standard techniques. A unique mark was assigned to each snake using scute removal (Blanchard and Finster, 1933). Marking the animals allowed us to identify repeated captures of the same individuals, both within and across field seasons. We also recorded the weight, length, sex, reproductive status and external features of the snakes, using standard procedures described for these animals (e.g. Macartney, 1985). In particular, we used the opportunity to investigate the validity of using a 'squeeze box' to measure the length of rattlesnakes, versus a direct approach such as measuring the animals along a meter-stick (Bertram and Larsen, unpubl.). Again, these data are not presented herein, but may prove useful to future investigations.

In an attempt to reduce the amount of time spent searching for snakes, 10 plywood boards approximately 1m $\times$ 1.5m in size, were placed in two areas of the Lac du Bois grasslands.

Table 4: Field Search Results

Areas Searched	Total Search Hours	Snakes Located *				
		Cv	*Pc*	*Cc*	*Te*	**Total**
Dewdrop Ecological Reserve and Area	88	8	0	0	0	8
Batchelor Hill Area, Lac du Bois	71	8	1	5	1	15
Frederick Area	30.5	5	1	3	0	8
Ashcroft Area	25.75	4	0	1	0	5
Westsyde Area	19	0	0	0	1	1
Tranquille burned out Pig Barn	29.5	1	0	2	0	3
Walhachin	60	5	8	2	0	15
Kamloops North Shore (East of Thompson River Junction)	32	6	0	0	0	0
Kamloops South Shore (East of, and including, Peterson Creek)	78.5	0	5	1	2	8
Copper Creek	3	0	0	0	0	0
Savona	2	0	0	0	0	0
Back Valley Road	4	3	0	0	0	3
Kamloops South Shore (West of Peterson Creek)	25.75	0	1	0	8	9
Total	**469 hrs**	**40**	**16**	**14**	**12**	**75**

Cv =** rattlesnake (*Crotalus viridis*), ***Pc = gopher snake (*Pituophis catenifer)*, ***Cc*** = racer (*Coluber constrictor*), ***Te*** = Western Terrestrial Garter snake (*Thamnophis elegans*)

3.3 Radio Telemetry

We tracked rattlesnakes and gopher snakes through the use of radio transmitters that were surgically implanted into the snakes. This enabled us to collect data on the habitat used by the animals in summer, and it allowed us to follow the animals through their autumnal migration back to the hibernacula (Table 5). Monitoring of the hibernacula located in 1999 and 2000 occurred in the spring of 2000 and 2001, respectively, and provided very rough estimates of the population sizes and compositions of the hibernating populations.

Using the criteria described in the first part of Section 3.2, we chose to radio-track rattlesnakes from the following general areas: lower Lac du Bois grasslands, Dewdrop Ecological Reserve/Lac du Bois Provincial Park, Rivershore, Peterson Creek, Valleyview and the areas immediately north of the village of Frederick and west of Walhachin (see map, page 43). Each area was searched until one, and in some cases two snakes suitable for transmitter implantation were found. Snakes were held no longer than 48 hours prior to the surgical implantation of the transmitters. Our collection, housing and surgical methodology was approved by the University College of the Cariboo (UCC) Ethics Committee – Animal Subjects, and the surgery itself was performed by veterinarians on faculty at UCC. Snakes implanted with transmitters were held for 24 hours after the procedure to monitor their recovery; they then were released at the exact location of their capture (with one exception- see section 4.5.1). Care was taken not to release animals during extreme periods of heat.

Transmitters (type: SB-2) were purchased from Holohil Systems, Ltd. (Ontario). We used one of two types of transmitters depending on the size of the snake. In the case of rattlesnakes, smaller snakes (SVL:660mm-668mm, weight :230g-350g) were implanted with transmitters with a life-expectancy of five months (weight: 3.8 grams). Larger rattlesnakes (SVL: 790mm-910mm, weight: 495g-667g) were implanted with larger 10-month transmitters (weight: 5.0 grams). The three gopher snakes we captured were all large enough to be implanted with 10-month transmitters (SVL: 850-1080, weight: 293-390).

Three of the transmitters still were emitting signals in the spring of 2000, so we were able to recapture two of these animals and surgically remove the transmitters. In spring 2001 three of six transmitters still emitting signals were removed. Removal of the transmitters before hibernation was not considered an option due to the probability of weakening the snake and therefore increasing the chance of winter mortality.

3.4 Spring visits to hibernacula

An attempt was made to visit the identified hibernacula in the ensuing spring. This was done to obtain an estimate, albeit a cursory one, of the relative number of snakes using each the hibernating sites. At the same time, we attempted to recover the snakes carrying transmitters, in order that the transmitters could be surgically recovered. When possible, snakes observed at the hibernacula were captured and individually marked.

Table 5: Summary of radio-telemetry portion of study

Location	Date Captured	Species*	Sex	Mark	Number of Visits as of 11/30 of year	Hibernaculum identified?
Frederick #1	July 21/99	Cv	F	R3L4	27	yes
Frederick #2	July 21/99	Cv	M	R3L5	2*	no**
Walhachin #1	June 1/00	Cv	F	R12L7	25	yes
Walhachin #2	June 1/00	Pc	M	L4	27	yes
Dewdrop #1	July 22/99	Cv	F	R3L8	24	yes
Dewdrop #2	July 20/99	Cv	F	L10	25	yes
Rivershore #1	June 16/00	Cv	M	VR3R3L5	22**	no***
Rivershore #2	July 10/00	Cv	M	VR3R3L9	17	yes
Rivershore #3	July 21/00	Cv	M	VR3R3L11	13	yes
Valleyview	July 14/00	Pc	F	L12	21	yes
Peterson Cr.	July 5/00	Pc	F	L11	23	yes
Lac du Bois #1	July 18/99	Cv	F	L7	26	yes
Lac du Bois #2	July 18/99	Cv	F	R4L7	26	yes
Lac du Bois #3	June 7/00	Cv	M	R12L10	30	yes
Tranquille Cr. #1	July 13/00	Cv	M	VR3R3L10	17	yes
Tranquille Cr. #2	June 1/00	Cv	F	R12L8	25	yes

*_Cv_ = _Crotalus viridis_ (rattlesnake), _Pc_ = _Pituophis catenifer_ (gopher snake)
** killed by a badger July 30/99
*** killed by a tractor August 30/00

We located the animals bearing transmitters two or three times a week after their release, until their entrance into hibernation. Data on the habitat type, weather, snake activity/visibility and geographic location were collected each time a snake relocated, and photographs of some of the sites were taken. Once the animals reached their hibernacula, we conducted routine monitoring of the sites until colder temperatures prevailed and it was clear that no other snakes would be returning to the sites.

4.0 RESULTS

4.1 Public Outreach

general:

Our 'hotline' received a total of 184 reports, and we obtained approximately another 15 sighting reports through direct interviews and conversations with residents of Kamloops and neighbouring areas. In the majority of cases, we were not able to confirm the accuracy of these reports, because we were not able to take the call at the exact instant it was made, or because the sighting had occured at some time in the past. However, there were 34 instances where we were able to respond to a call in time to allow confirmation of the sighting (also, in some cases, the snake(s) had been killed). Based on these confirmations, we can say that the majority of rattlesnake reports were accurate, but the same cannot be said for reports of gopher snakes. The Western Terrestrial Garter Snake often is misidentified as either a gopher snake or, in cases, a rattlesnake, even by people with considerable naturalist skills**. This suggests that extreme caution must be taken when considering the reliability of gopher snake sightings, and to a lesser degree, rattlesnake sightings.**

Given the above, we judged a report of a snake sighting to be 'reliable' only if it met the following criteria:

- the snake subsequently was located by the investigators
- a photo record of the sighting had been made and/or
- the investigators judged the reporter to have extremely strong snake identification skills; this was determined subjectively through extensive questioning, conversation and knowledge of the reporter's background, experience, and/or current profession (but see below). Photographs of various snake species sometimes we shown to the reporter to gauge his/her snake identification skills. If there was any uncertainty on our part or the that of the reporter, the species identification was judged unreliable.

Door-to-door canvassing, public presentations, and wide-spread pamphlet distribution allowed us to interact with the public on a personal level. Although this type of work is time-consuming it is an effective way of disseminating accurate and personalized information to the public. As discussed above, we found in general that the public does not have the experience and skills needed to make an accurate identification of snake species, even with our information pamphlet in-hand. The small number of reports that were deemed 'reliable' however, did serve to confirm leads we had obtained from professionals in the field of wildlife biology/management and provide some insight into the historical patterns of snakes in the Kamloops area. Efforts were focused on media-coverage in 2000, but pamphlet distribution was still used in residential and commercial areas specifically targeted for investigation.

Where in general were rattlesnakes reported?:
Information from our 'reliable' reports, coupled with our own surveys, indicated that rattlesnakes were more likely to be detected in two general locations within the study area. First, the north side of the Thompson valley from east of Kamloops to Cache Creek, and second, both sides of the Thompson valley from Ashcroft to Spences Bridge. The lower Lac du Bois grasslands and the Dewdrop Ecological Reserve/Tranquille River were the two most common areas where rattlesnake sightings by the public occurred (see map, page 43).

Where in general were gopher snakes reported?:
Gopher snakes were reliably detected in the same general areas as rattlesnakes, as well as in the grasslands along the south side of the Thompson valley from east of Kamloops to at least Savona. The most common areas for gopher snake sightings, likely due to the large number of people using these areas for recreation, were the Peterson Creek and Mt. Dufferin/Kenna Cartwright Park areas (see map, page 43). Roadkill specimens provided direct evidence that the animals are present and do move into the city. Road-killed gopher snakes have been found on the University College of the Cariboo campus and in the Mission Flats area in the past few years (Larsen, pers. observ.). Just outside the city limits, several road-kill gopher snakes were collected from the paved road crossing the Tranquille River near its mouth.

4.2 Historical Perspective

The information we received on the historical presence and abundance of rattlesnakes and gopher snakes came from our conversations with the public and professionals in the field of wildlife biology and management. Although most of this information cannot be confirmed, multiple reports containing similar information help to increase our confidence. A very common sentiment among those who were interviewed in areas bordering rattlesnake and gopher snake habitat was that sightings and encounters were more common in the past. A tribal councilor with the Kamloops Indian Band (Russell Casimir) recalled bounties paid for rattlesnakes by agriculturalists in this area, in what are now known as the Tranquille and Brocklehurst neighborhoods. Several long-term residents of this area also told us how as children they would observe, tease or kill

'large' numbers of rattlesnakes in these areas. The word 'large' in this case may mean three, thirty, or three hundred, but our inventory and radio-tracking work (see below) has shown that the hibernacula currently used by rattlesnakes above and west of Kamloops all occur along the rocky bluffs immediately above the floor of the Thompson River valley. Thus, it is quite likely that there were other historic hibernating populations close to the valley bottoms, and that these populations have now been eliminated by human activities. We in fact heard reports, albeit unconfirmed, of the use of explosives to intentionally destroy hibernacula.

Historic reports of rattlesnakes also came from long-term residents of the area east of the Lafarge cement plant (north side of the South Thompson River across from Monte Creek) and the base of Paul Mountain in the Kamloops region (see map, page 43). **Again, these people stated that in the recent past (10-20 years) rattlesnake sightings were regular occurrences, whereas now they are increasingly rare.** Another report stated that rattlesnakes were once present in the area of the University College of the Cariboo and Dalhousie Drive on the south shore of the Thompson River in Kamloops, yet they no longer are observed in this area. **Our work suggests that rattlesnakes likely have been extirpated from the south-side of the Thompson rivers between Chase, and at least the west-end of Kamloops lake.**

4.3 Field Search Results

general:

We observed 56 individual rattlesnakes and gopher snakes during approximately 469 hours of active field searching, or approximately 8.4 hours per snake. If racers (another blue-listed species) and garter snakes are included, the return on our work was approximately 5.7 hours per snake. **Most of the rattlesnakes and gopher snakes that we located were found associated with some type of cover object, for example, adjacent to or under rocks, logs, bark and old buildings.** We found that focusing our search efforts on these types of features, on warm days, in areas where sightings had been reported, proved to be the most efficient method of locating the target snake species.

Success at locating animals generally was observed to increase under certain environmental and site specific conditions, for example, warm air and ground temperatures, negligible to moderate winds and precipitation, and the presence of habitat features such as rock outcrops, coarse woody debris and man made sources of cover (i.e. cement berms, old buildings, garbage).

rattlesnakes:

Overall we located 40 rattlesnakes during our field searches. Searching for rattlesnakes occurred primarily in the Bunchgrass (BG) biogeoclimatic zone within the Southern Interior (SOI) ecoprovince. Rattlesnakes were located in the Thompson Basin (THB) ecosection. In 36 cases, rattlesnakes were found under or beside cover objects such as rocks, logs or sagebrush plants, in the remaining 4 cases the snakes were found moving across or beside roads. When rattlesnakes were found on sloping terrain, the average

aspect and slope of the locations were 166^0 (south- southeast) and 30%, respectively. Still, approximately one-third of the locations where rattlesnakes were found were flat (no slope and aspect). Rattlesnakes always were found in or within 200m of areas that contained a significant rocky component such as an outcropping or bluff area, or strewn boulders.

gopher snakes:
A total of 16 gopher snakes were found while searching. Again, the bulk of searching hours were spent in the BG biogeoclimatic zone; therefore, this is where all of the gopher snakes were found. Gopher snakes were found in the THB ecosection of the SOI ecoprovince. Cover objects such as sagebrush plants, rocks, garbage bags and rodent holes all were used by the snakes. Gopher snakes were found in flat areas approximately 50% of the time. The average aspect and slope of the locations which were not flat were 111^0 (east south east) and 12% respectively. In general, gopher snakes were found in an open grassland environment dominated by vegetation such as sagebrush and bunchgrass.

test survey:
Throughout the study, we realized that detecting snakes in a given area often was very difficult, and repeated visits often were necessary to reasonably establish whether snakes were or were not present. To investigate this problem further, and to gain comparative data, two people from our crew with training and experience in snake searching travelled to the Okanagan in August 2000. A total of 14 hours were spent searching in two locations with well-established rattlesnake populations (Kalamalka Lake Provincial Park, and the Haines Ecological Lease). At the former location, no snakes were observed, and at the other site, two rattlesnakes, one common garter snake and one racer were located. This translates into 7 hours of searching per target snake species (rattlesnakes and gopher snakes) and 3.5 hours per snake, for all snake species. Although these numbers are slightly lower than what we experienced in the Thompson region, it is difficult to conclude that snakes are more common in the Okanagan due to the lack of repeated searches. **However, what this does clearly show is that short-term inventory searches, even by experienced people, cannot supply reliable inventory data on the relative abundance or absence of these animals from an area.**

4.4 Observed Mortality

Three causes of mortality were observed during our study. These were road-kill (and other vehicle caused deaths), persecution by humans, and natural predation.

A total of four gopher snakes in three different locations were found dead on roads, obviously run over by vehicles. Two road-killed rattlesnakes in two separate areas were observed. In addition, one of the rattlesnakes that was implanted with a radio transmitter was killed by a tractor operating on a small piece of fenced private land that the snake had moved into. In a similar case, the carcass of a gopher snake killed by a crop harvesting vehicle was collected and submitted to the researchers. One of each of the

observed rattlesnake and gopher snake road-kills were the result of snake 'hotline' calls. Several additional unconfirmed reports of rattlesnake and gopher snake road-kills also were received.

Two rattlesnakes with their heads and tails removed were found during our field searches, both near roads in areas where humans commonly hike/walk. Additional examples of human persecution of rattlesnakes were observed as a result of the snake 'hotline'. On two occasions, once in each year of the study, a total of three juvenile rattlesnakes were killed by residents of a mobile home park who found the snakes in their yards. Observations of other species of snakes being killed by humans also were made: two people from two separate areas killed a total of four Western Terrestrial Garter Snakes that had wandered into their yards. In one case the garter snake had been misidentified as a rattlesnake and therefore was killed. The reasons for the second incident were not clear.

One example of predation was observed. The remains of a rattlesnake which had been implanted with a transmitter were found beside a rock under which a badger was observed to be hiding. Evidence that the badger had killed and eaten the rattlesnake was present.

4.5 Radio Telemetry Results

We attempted to locate each snake every third day after its release, until entrance into its hibernaculum. The rattlesnakes were visited a total of 277 times, the gopher snakes 71 times; on average, each snake was located 23 times (see Table 5). Occasionally, we could not locate an animal for several days: in some cases we believed this was due to the rolling, hilly terrain blocking the signal after the snake had moved. At other times, our tracking efforts were hampered by significant radio interference caused by our close proximity to Kamloops.

The exact locations of each hibernacula were recorded using hand-held GPS devices. **Due to the sensitive nature of these data, we are not including in this report the maps of individual snake movements nor references to precise locations.** These data have been forwarded to the Conservation Data Centre in Victoria, British Columbia, where access to them is restricted.

4.5.1 Rattlesnakes

A total of thirteen rattlesnakes were implanted with transmitters; one animal was killed shortly after release (see Section 4.4. above), but the other animals (5 ♂, 7 ♀) all supplied habitat data over various lengths of time. These snakes were found and monitored in the Lac du Bois, Dewdrop, Frederick, Rivershore, Tranquille and Walhachin areas.

After transmitter implantation the snakes were released at the exact location of their capture, with one exception. One of the rattlesnakes captured in the Rivershore area was found by residents in their yard located on the south side of Shuswap Road. The rattlesnake was released approximately four hundred meters away on the north side of

Shuswap Road. The two main reasons for releasing the snake at this location were that the residents had young children and the snake was captured only meters from their play area, and that we felt it might reduce the chance of mortality to the snake, due to roadkill. The rattlesnake made several movements throughout the remainder of the active season and eventually reached a location confirmed to be a hibernaculum.

general habitat selection:

A total of 268 slopes and 271 aspects were used to calculate the mean slope and aspect used by the thirteen rattlesnakes during each of the ten two week periods that occur between June and October (Figures 1 and 2). In general, rattlesnake were found on steeper slopes in the early spring and fall (while at or near hibernacula) than during the summer when they presumably were foraging. The mean slope values calculated for each two week period between June 1 and September 20 ranged from 19.8 % to 42.3 % (Figure 1). During the final four weeks (September 21-October 18), when the snakes were entering into hibernation, the mean slopes of rattlesnake locations were 56.6 % and 62.3 % (Figure 1). During the active season (June 1 – September 20), the mean aspect values of rattlesnake locations for each two week period ranged between 71.7^{o} and 168.3^{o} (Figure 2). The mean aspect range over the remaining four weeks when the snakes were returning to and entering the hibernacula was 209.6^{o} and 205.6^{o} (Figure 2).

seasonal movement:

Eight of the rattlesnakes with transmitters did not move any further from their hibernacula than their original point of capture, the remaining four moved further away from their hibernacula before reversing the direction of their movements. The maximum distances achieved by each rattlesnake, measured in a straight line from the hibernacula, range from .29 km to 1.7 km (mean=1.05 km) (see Table 6). Calculations of home range must be viewed cautiously due to the fact that implantation and tracking began after the start of the active season; also, the traditional concept of a 'home range' likely does not apply to these animals (i.e. the animals do not necessarily use or require all of the polygon defined by their locations). Still, minimum-convex polygon estimates of home range size were been determined using the locations recorded for each telemetered snake. The mean home range size of male and female rattlesnakes was 39.2 ha and 14.1, respectively (see Table 6). The home range size of the gravid female was approximately 0.12 ha.

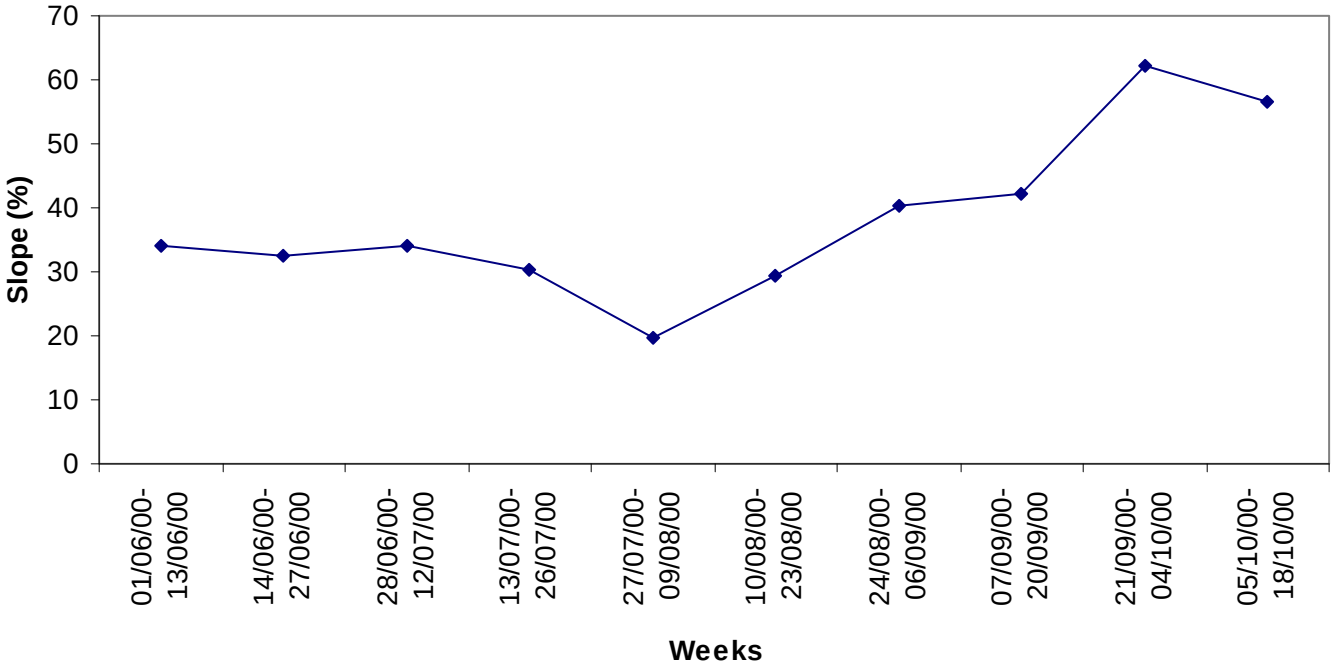


Figure 1. Mean slope values of rattlesnake locations calculated over two week periods between June and October (1999 and 2000 combined). Data comes from a total of thirteen rattlesnakes that were followed using radio telemetry.

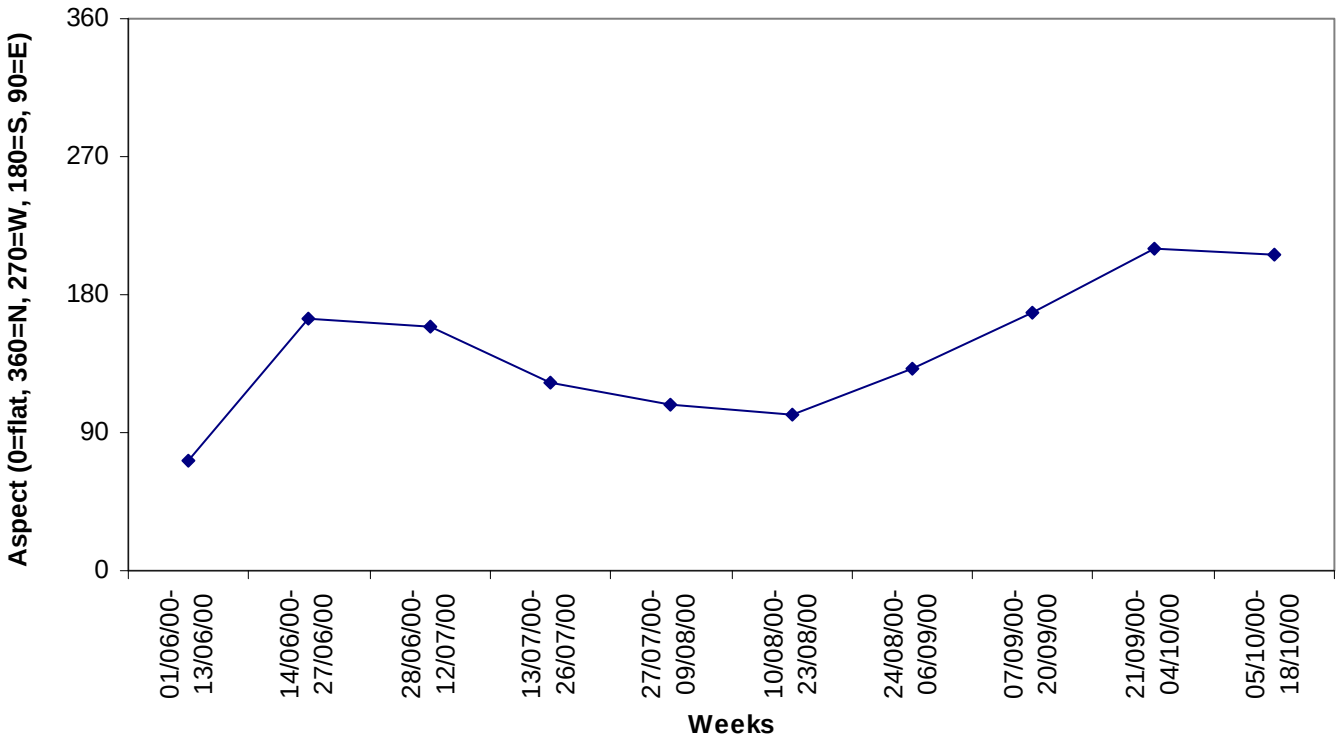


Figure 2. Mean aspect values of of rattlesnake locations calculated over two week periods between June and October (1999 and 2000 combined). Data comes from thirteen rattlesnakes followed using radio telemetry.

Table 6: Home Range Sizes and Maximum Distances from Dens

Female Rattlesnakes	Max Distance (km)	Home Range (ha)	Male Rattlesnakes	Max Distance (km)	Home Range (ha)
Walhachin	.29	5.06	Tranquille #1	.92	27.5
Tranquille #2	.67	7.75	Rivershore #1	1.12	7.68
Lac du Bois #1	3.0	47.36	Rivershore #2	N/A*	N/A*
Lac du Bois #2	1.4	6.66	Rivershore #3	.93	44.32
Dewdrop #1	1.3	4.8	Lac du Bois #3	1.4	103.5
Dewdrop #2	1.3	15.2	Frederick #2	N/A*	N/A*
			***killed**		
MEAN	**1.32**	**14.47**	**MEAN**	**1.09**	**45.75**
STANDARD DEVIATION	**.93**	**16.56**	**STANDARD DEVIATION**	**.22**	**41.31**
Frederick #1 (Gravid female)	*.3*	*.12*			

Gopher Snakes	Max distance (km)	Home Range (ha)	Sex
Valleyview	.52	9.92	female
Peterson	.51	12.48	gravid female
Walhachin	.28	5.69	male

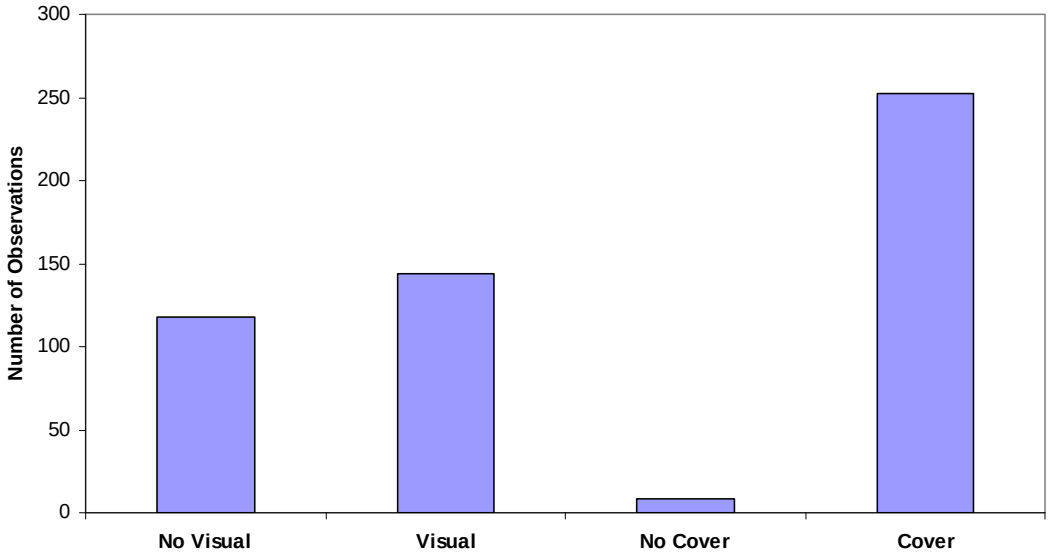


Figure 3. Number of times that radio-tracked rattlesnakes were and were not visible to the investigator (two bars on left), and number of times the animal was using or immediately adjacent to some sort of cover (two bars on right).

use of cover objects:

We were able to obtain visual sightings of the rattlesnakes with transmitters on 53% (142 times out of 268) of the radio-checks (Figure 3). At the same time, the snakes were nearly always using or immediately adjacent to some sort of cover object (Figure 3).

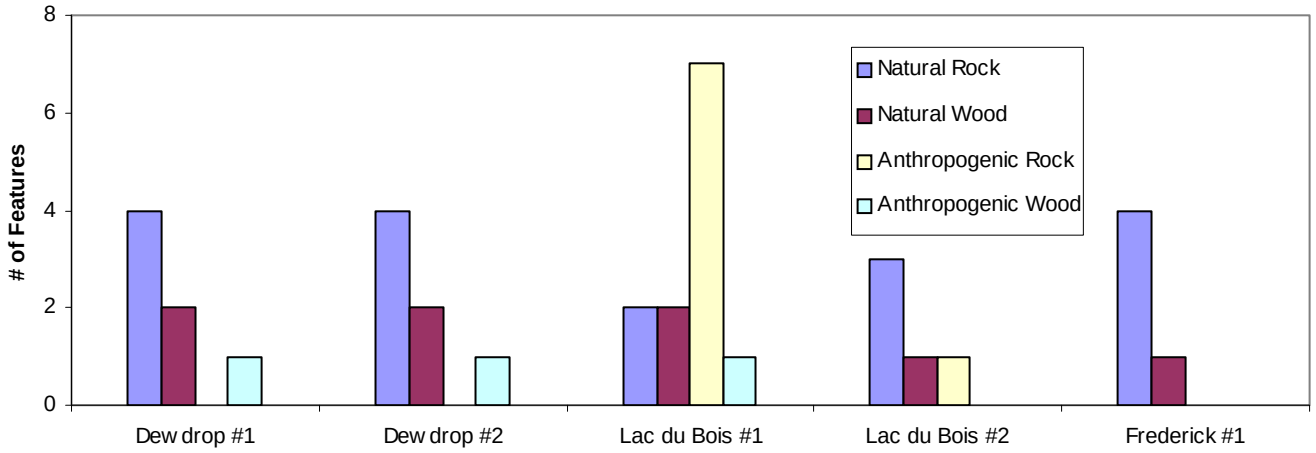
Figure 4 shows the relative use of natural and anthropogenic cover objects by the rattlesnakes. All but one rattlesnake used natural rock and wood features more often than anthropogenic features Examples of anthropogenic features include piles of rock and wood created by human activities such as road or pipeline construction, concrete berms and discarded wood/metal. It should be noted that all of the rattlesnakes used some type of anthropogenic cover object (rock or wood) at least once.

The types of rock formations that were used by the rattlesnakes ranged widely, and included: 1) large solitary boulders with cavities under them, 2) small piles of rock (~30 cm diameter) containing spaces, 3) talus slopes (usually made up of rocks of uniform sizes) and 4) cracks, holes or other openings in large (> 2 m diameter) solid rock outcroppings. Anthropogenic rock structures such as rock piles resulting from road, pipeline and power line construction also were used.

Figure 5 categorizes the rock and/or concrete cover objects that were used by the rattlesnakes with transmitters. Large rocks (>30 cm diameter), clusters of smaller rocks (<30 cm), talus, rock bluffs and concrete structures were used as cover. Proximity to roads also was noted. A disturbing trend occurred in Lac Du Bois, two rattlesnakes tracked in this area moved to and used concrete berms placed alongside the main road. Rattlesnakes (without transmitters) in other areas (i.e. Dewdrop) also were observed using theses berms. In addition, broken chunks of concrete discarded beside a road also were used by one rattlesnake as cover. None of the telemetry snakes were observed on the roads or railway but several were seen in close proximity (i.e. in the ditch) therefore putting them at risk from vehicle and foot traffic. One rattlesnake, however, spent several weeks within 50 m of a paved road and was killed by a small tractor clearing sagebrush on a piece of private land adjacent to the road.

The types of course woody debris (CWD) that rattlesnakes used appeared to depend upon what was available. We followed rattlesnakes in locations where trees were present in the habitat (i.e. Dewdrop), and here rattlesnakes were observed using CWD such as downed trees, stumps and tree debris (for example, bark and branches) as cover. In areas such trees generally were absent from the habitat (e.g. grasslands immediately north of the Kamloops' Batchelor Heights neighbourhood. Here, thick patches of woody weeds and dead sagebrush often were used as cover, as well as anthropogenic wood objects such as discarded boards and tree/shrub clippings.

The most common wood features used by rattlesnakes were relatively large sagebrush plants in close proximity to coarse woody debris (Figure 6). In habitats where coarse-woody debris was present, rattlesnakes showed a strong affiliation with this type of cover. Thick patches of woody weeds found on roadsides and disturbed areas also were used as cover on several occasions.



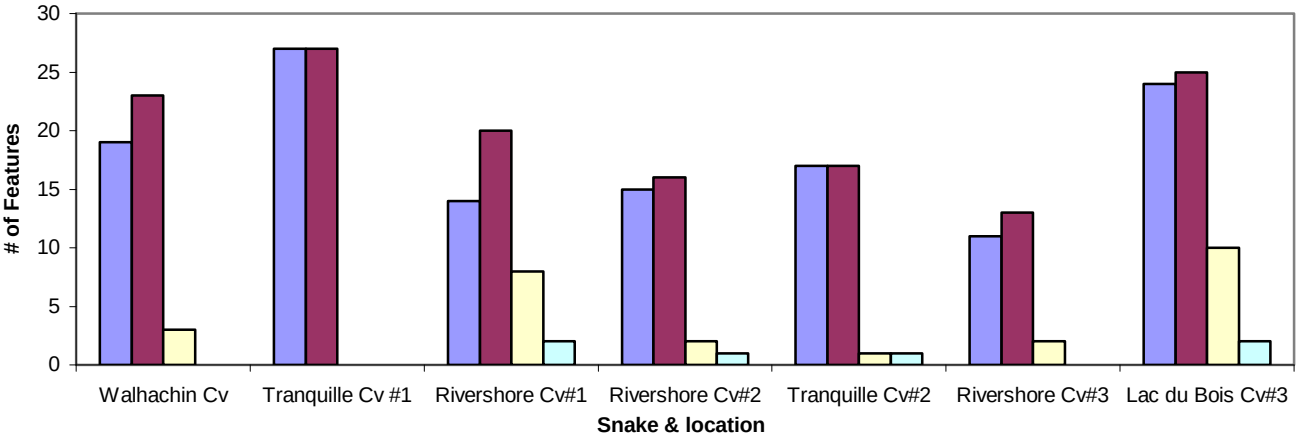


Figure 4: Use of natural and anthropogenic wood and rock features by rattlesnakes with transmitters. Top graph - 1999 observations; bottom graph - 2000 observations.

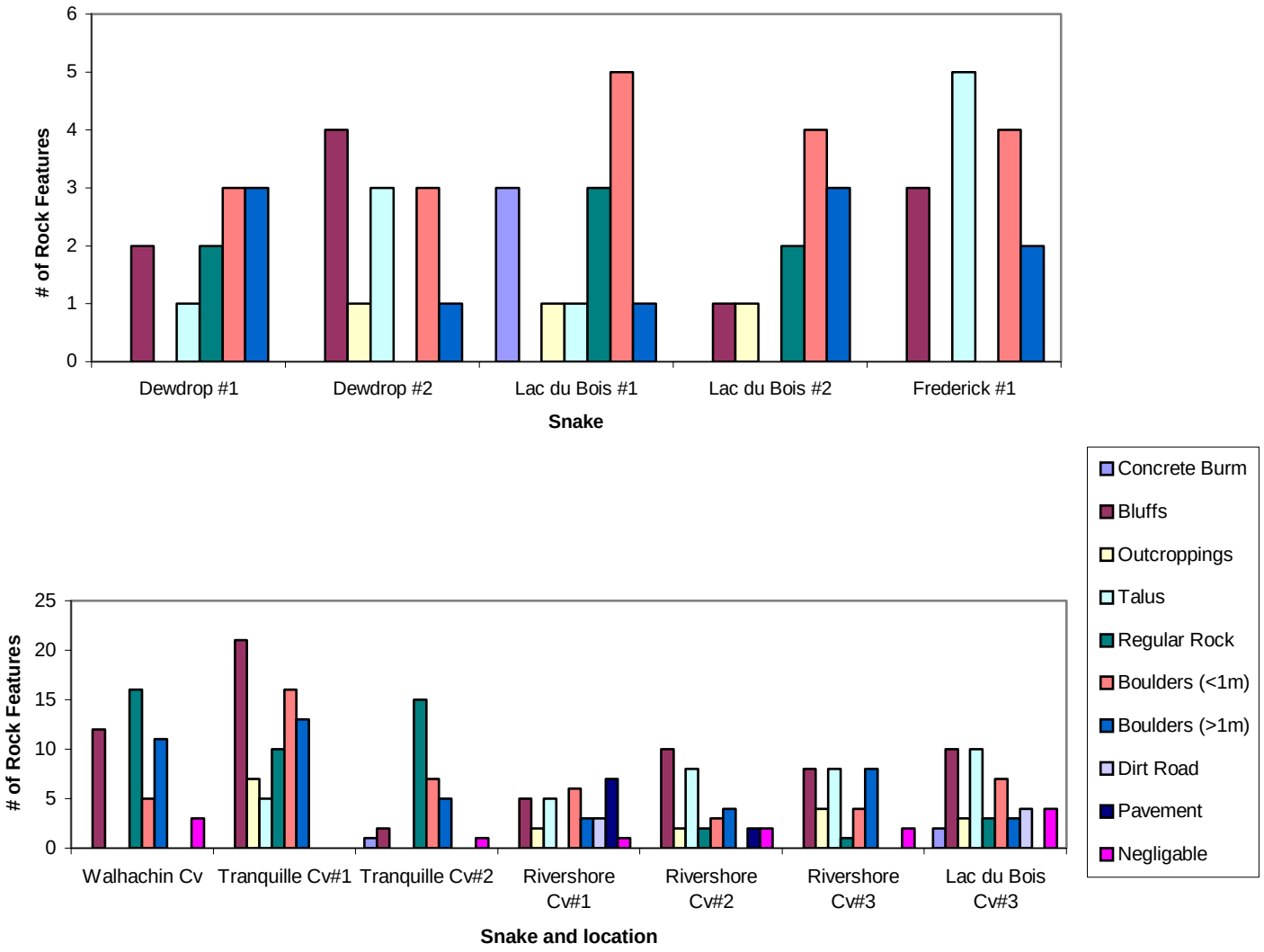


Figure 5. Use of various rock features by rattlesnakes with transmitters in the Walhachin, Rivershore, Tranquille and Lac du Bois areas between June and October. Top graph: 1999 observations; bottom graph: 2000 observations.

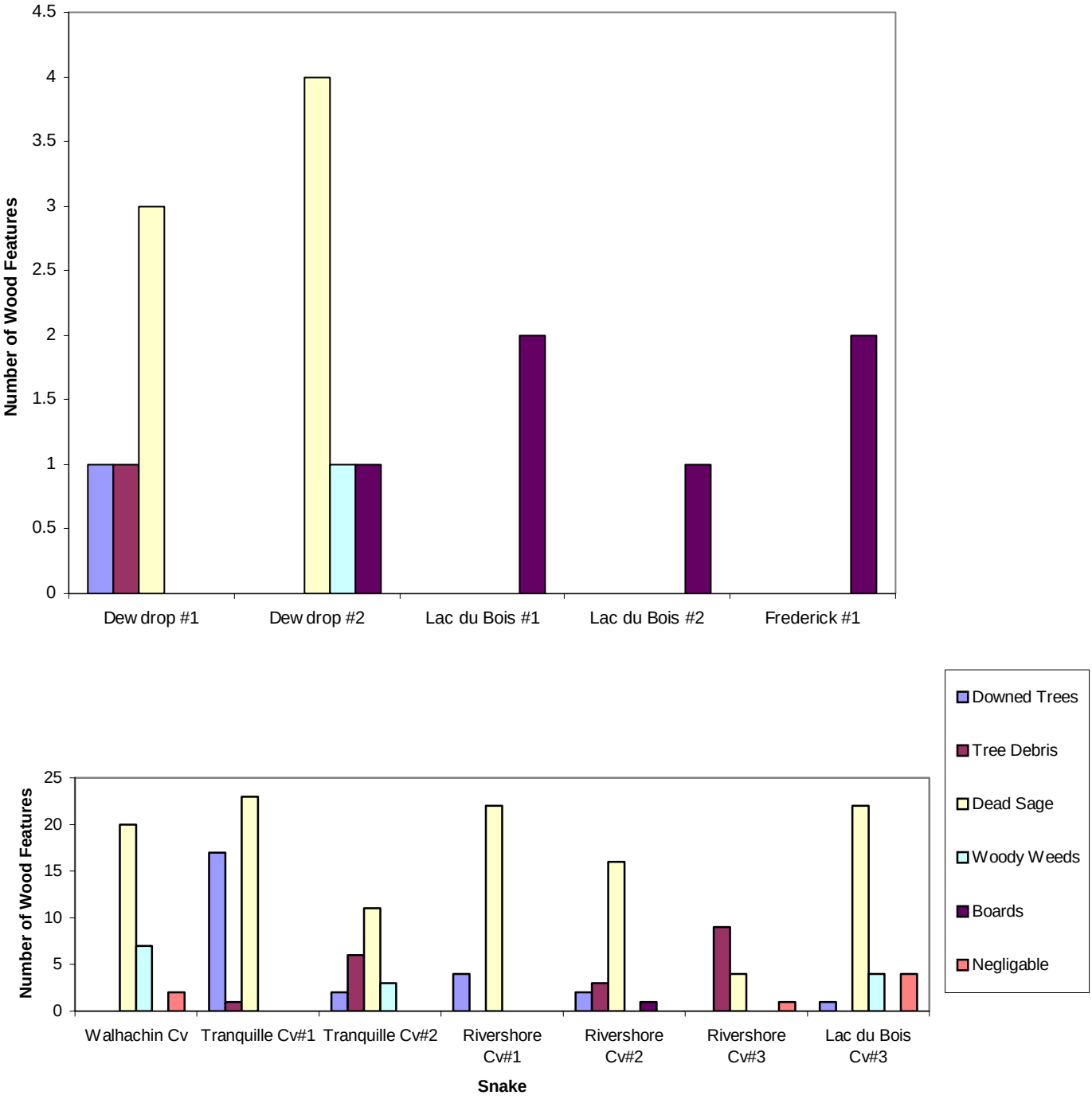


Figure 6: Use of varous wood features by rattlesnakes with transmitters, between June 1 and October 17. Top graph: 1999 observations; bottom graph: 2000 observations

parturition data:
The one gravid female that we tracked gave birth on August 31 +/- 2 days, when a single offspring was observed laying in her coils. This date was considerably later than that reported by Macartney for gravid females in the Vernon area during 1980-83. Investigation around her basking site revealed 6 unfertilized ova. The 1999 spring and summer weather in the Kamloops area was unusually cold and wet (Environment Canada data), and delayed and failed parturition also was observed in a coincidental study on garter snakes being conducted by KL.

hibernacula:
A total of ten rattlesnake hibernacula were found using radio telemetry. The locations were found on slopes between 30 and 85% with aspects of between 160^{o} and 247^{o}. Seven of the hibernacula entrances were cracks in rock outcroppings that were part of a larger complex of rocky features including bluffs, boulders, talus slopes and additional outcroppings. The remaining three hibernacula also were located in very rocky areas, the entrances to the dens however were less conspicuous and harder to clearly identify since they were covered by talus like piles of rocks.

locations of other hibernacula:
Three additional hibernacula were located after intensively searching areas suggested to us during conversations with members of the public. Two on the north shore of Kamloops Lake, and a third south of the town of Ashcroft. The presence of two or more gravid females was used to identify the sites as probable hibernacula. The sites were monitored in the spring of 2000 and clear evidence of hibernating populations was documented at two of the sites. The characteristics of these three hibernacula are similar to those found using radio telemetry. Two of the entrances are in rock cracks (the third is unknown), one on the rocky edge of a gully, the second at the base of a complex of bluffs, outcroppings and talus. The slope and aspect of the three locations ranges from 29-76% and 223-245^{o}, respectively.

4.5.2 Gopher Snakes

Three gopher snakes suitable for transmitter implantation were captured. One gravid female, one female and one male from the Peterson Creek, Valleyview and Walhachin areas, respectively, were followed throughout the summer

general habitat selection:
The mean slopes and aspects used by the three gopher snakes with transmitters during each two week period between June and October were calculated (Figure 7 and 8). Probably due to the small size of the gopher snake slope and aspect data set (71 locations) the mean values calculated for each two week period are quite variable and trends are difficult to identify. The mean slope values for each two week period in the active season (June 1–September 20) range from 0% (flat) to 27.4%, during return migrations to hibernacula (September 21-October 18) the two week mean slopes were 24.4% and 36.7% (Figure 7). Mean aspect values for the active season ranged from 0^{o} (flat) to 204.9o (Figure 8). During the four weeks before hibernation, the mean aspects for each two week period were 69.3^{o} and 156.4^{o} (Figure 8).

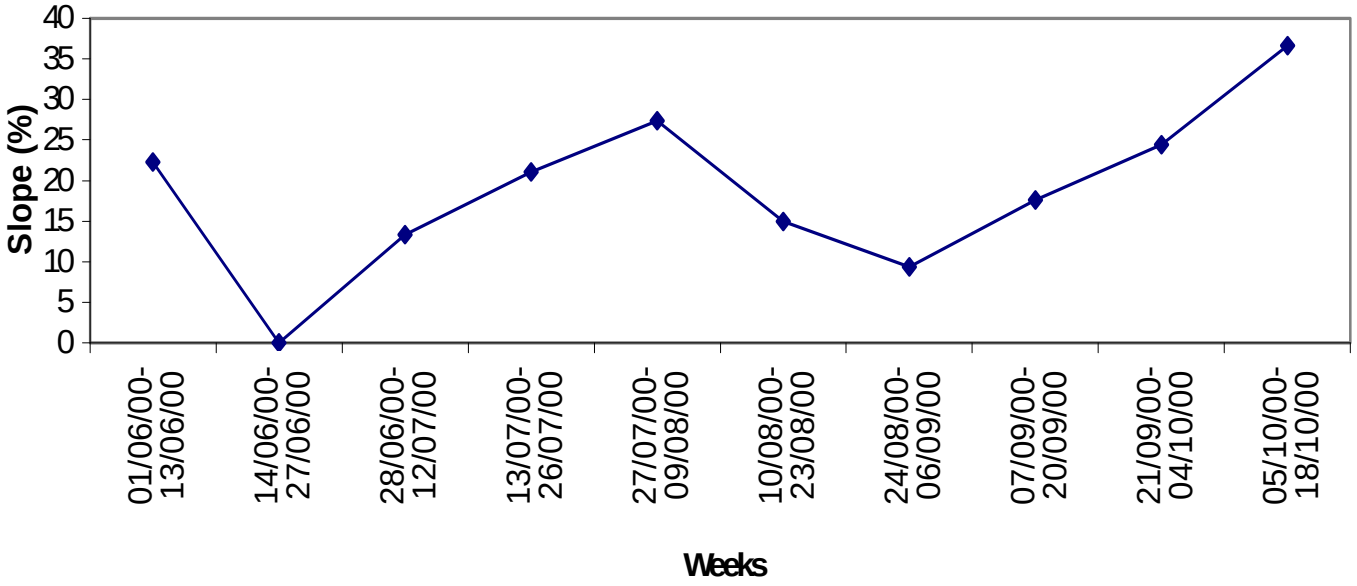


Figure 7: Mean slope values of gopher snake locations calculated over two week periods between June and October 2000. Data comes from three gopher snakes that were followed using radio telemetry.

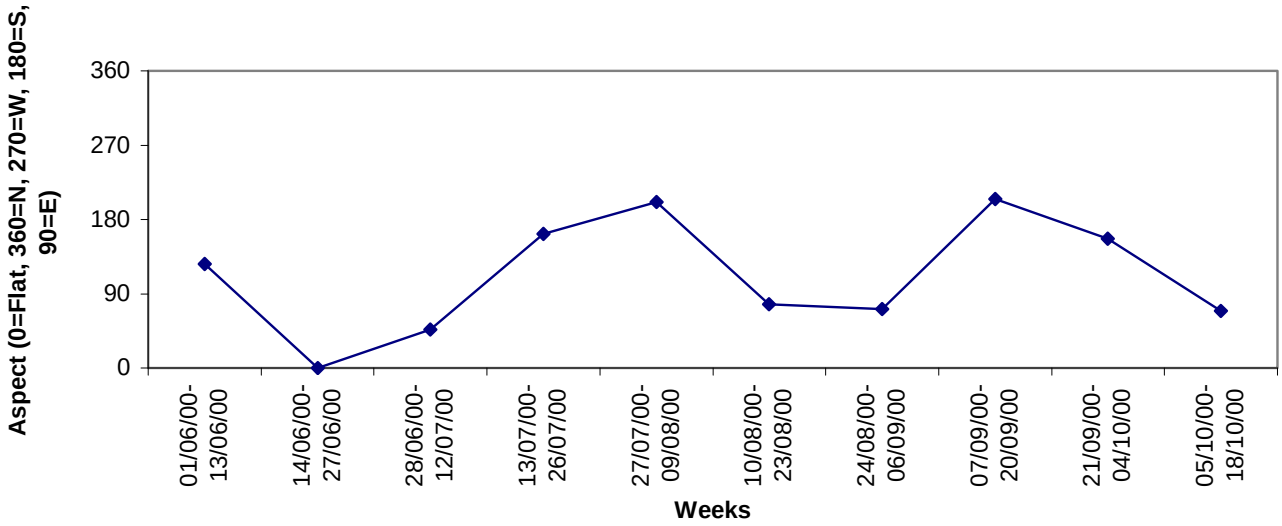


Figure 8. Mean aspect values of gopher snake locations calculated over two week periods between June and October 2000. Data comes from three gopher snakes followed using radio telemetry.

general habitat selection:

Because we radio-tracked only three gopher snakes, it is difficult to identify trends in the data. During the summer, these three snakes generally were found in areas with aspects primarily ranging between east and south on slopes with a 10-30% grade. Flat areas with no slope or aspect also were used on several occasions.

Of the three gopher snakes that were followed using radio telemetry, significant rock features were found in two of the three habitats. A long slope of rocks (10-30 cm in diameter) created through clearing of an agricultural field was regularly used for cover by one of the gopher snakes, while rock piles within a large gully were used by another. The third gopher snakes home range bordered on a residential area therefore discarded concrete and metal often were used as cover.

use of cover objects:

Our telemetered gopher snakes were visible to the investigator 43% of the time (31 times out of 72) that they were located (Figure 9). Overall, some sort of cover was being used or was immediately available on 99% (71 times out of 72) of the radio telemetry visits (Figure 9).

The most common source of cover for gopher snakes was rodent holes, particularly for two of the three snakes. Gopher snakes routinely were observed basking outside rodent holes, into which they retreated when our presence threatened them. On several occasions gopher snakes were observed using the same rodent hole as cover for periods of up to ten days. The Valleyview and Peterson Creek gopher snakes were found underground in rodent holes during approximately half of the radio telemetry visits (13 times each).

The gopher snakes also used a variety of rock and wood features as cover (Figure 10). All three of the gopher snakes used anthropogenic cover objects such as old boards, garbage and rock piles at some point while they were being radio-tracked. Two of the three snakes used natural cover objects more frequently than anthropogenic (Figure 11). The third gopher snake, at Walhachin, used a long section of rock slope created by an agricultural field clearing, and it frequently used these rocks as cover.

The woody structures used by gopher snakes were large sagebrush plants with a dead woody component. Although the Walhachin gopher snake was not observed using rodent holes, it was found underground in an old stump on seven occasions (curled up with a rattlesnake) and in the thick vegetation of a swampy area on eight occasions. In terms of CWD, dead sagebrush, woody weeds and discarded boards also were used as cover by this animal.

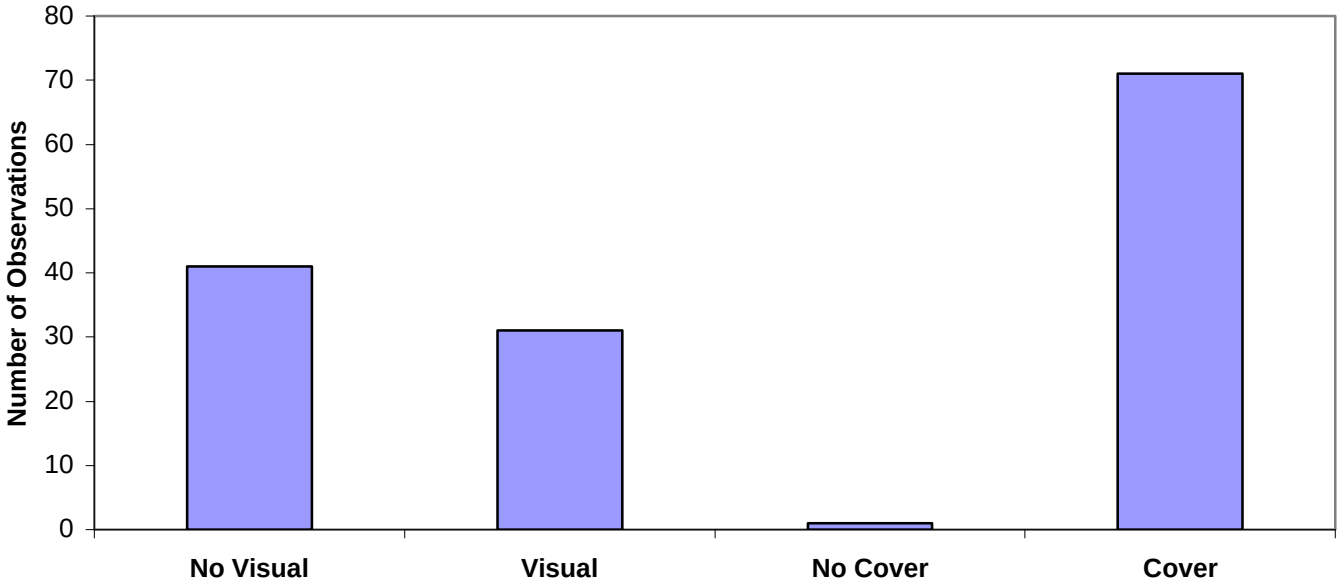


Figure 9. Number of times that radio-tracked gopher snakes were and were not visible to the investigator (two bars on left), and number of times the animal was using or immediately adjacent to some sort of cover (two bars on right)

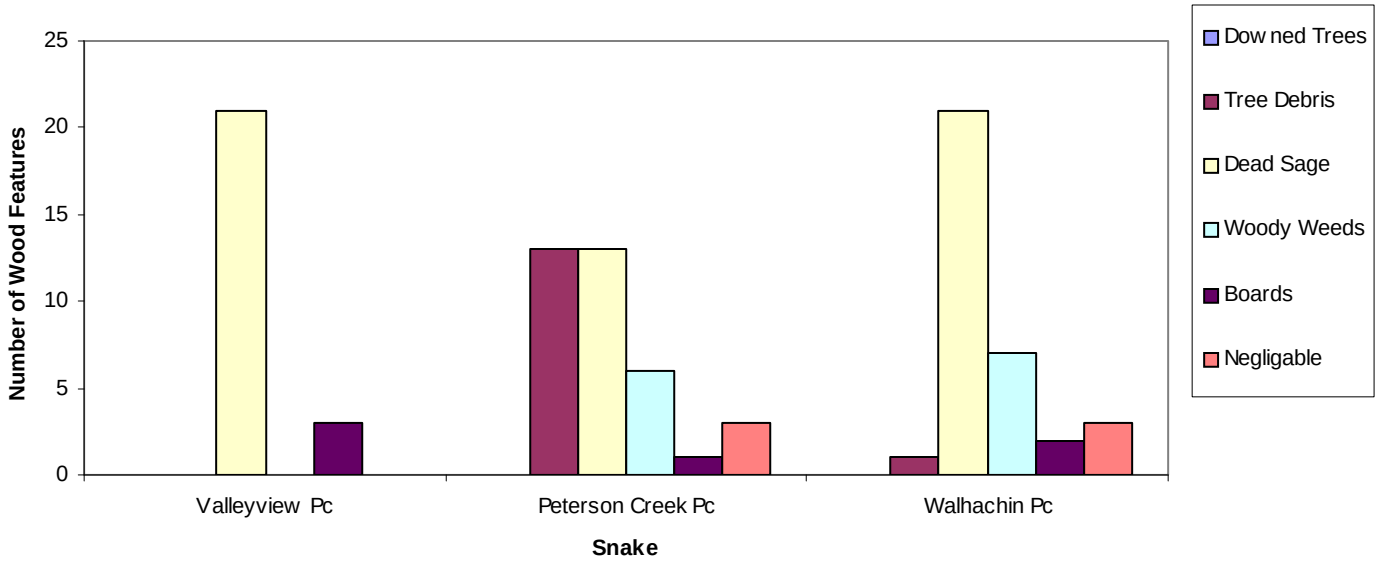


Figure 10. Use of varous wood features by gopher snakes with transmitters in the Peterson Creek, Valleyview and Walhachin areas between June 1, 2000 and October 18, 2000.

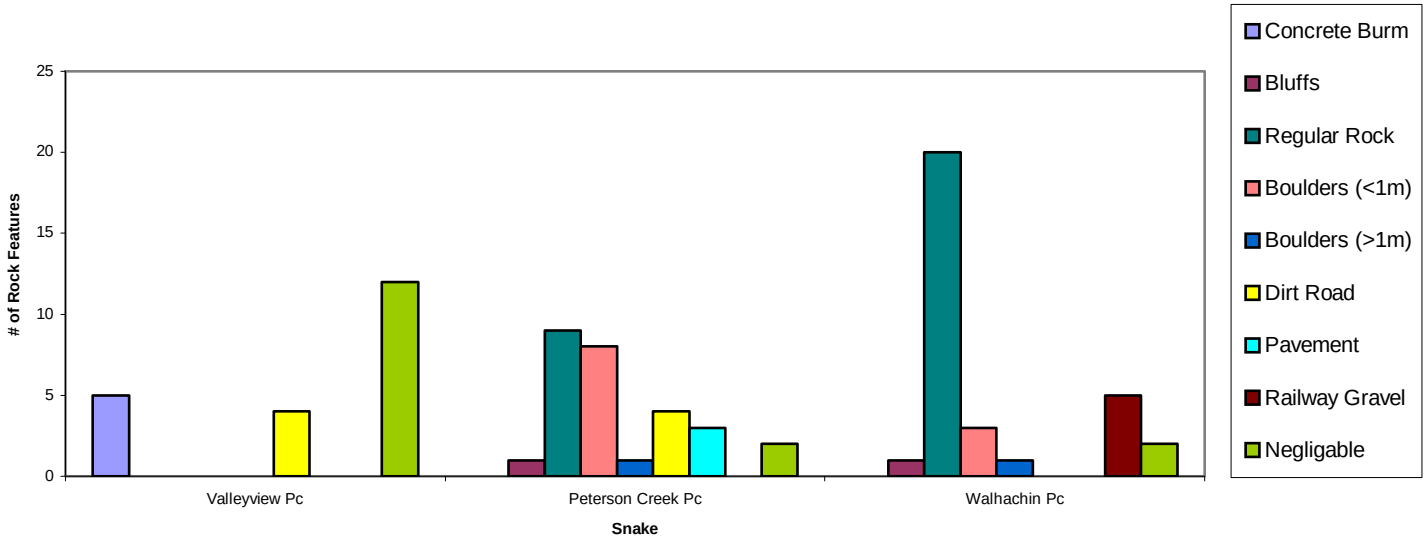


Figure 11. Use of various rock featues by gopher snakes with transmitters in the Peterson Creek, Valleyview and Walhachin areas between June 1, 2000 and October18, 2000.

seasonal movement:
One of the three gopher snakes did not move any further from its hibernaculum after being released from transmitter implantation. The mean maximum distance (measured in a straight line from the hibernacula) that the gopher snakes travelled from their hibernacula was .453 km. The size of home ranges for these snakes were determined to be 9.9 ha for the female, 5.7 ha for the male and 12.5 ha for the gravid female (see Table 6). Again, since tracking began after the beginning of dispersal, these home range calculations should be viewed cautiously.

oviposition data:
The one gravid female gopher snake that we tracked was carrying seven ova (determined through palpation at time of transmitter implantation). This female deposited her eggs in a large sand bank between July 10 and July 20. Although we did not actually witness her laying the eggs, we recaptured her very briefly on July 20th to verify that she had laid her eggs. The egg-laying site was a large south east (130^{o}) facing sand bank, approximately 50m in height and 100m in length. Sporadic bunchgrasses and small sagebrush plants were growing on the 42% slope. The soil was loose and rodent holes were present throughout.

hibernacula:
Three gopher snake over-wintering sites were identified using radio telemetry. The three sites were considerably different from each other. The first was located in the gravel bed of a railway track, the snake over wintered in a cavity formed by the decaying branches of a dead sagebrush plant partially covered by the railway gravel. This site was located in an open, flat area with negligible slope and aspect. The second site was found on the side of a dry gully, approximately 2m in depth. The gopher snake at this site spent the winter in a complex of rodent holes. The slope and aspect of this location are 9% and 179^{o}, respectively, and the soil was a sandy-clay type. The third location was on a very steep (130%), north east (54^{o}) facing slope of a creek gully that was approximately 100m in depth.

4.6 Spring visits to hibernacula

Logistics, weather and backroad conditions made it impossible for us to visit all of the hibernacula in the spring following the year of their 'discovery'. For those hibernacula that we did visit, the number of visits varied from two to six, as in some cases, concerted efforts were necessary to recapture the telemetered snake from a particular hibernaculum. Table 7 summarizes the results of our spring work at the hibernacula. These data should be viewed as very cursory, as the visits to the hibernacula were irregular and in some cases, made during relatively poor weather when snakes would not be expected to be visible. Also, snakes that eluded capture may have been counted twice. Still, there is a suggestion that the rattlesnake hibernacula in the more remote areas contained more snakes.

Table 7. Summary of data collected on rattlesnakes during spring visits to identified hibernacula. Rattlesnakes and gopher snakes that were captured were classified as 'adult' (>100 g) or 'juvenile' (<100 g). Species codes are as follows: **Cv – *Crotalus viridis,* rattlesnake; Pc – *Pituophis catenifer*, gopher snake; Cc – *Coluber constrictor*, racer; Te – *Thamnophis elegans,* western terrestrial garter snake**

Hibernaculum 'code-name'	**Number of spring visits**	**Number snakes captured**	***Number adults (≥100 grams)***	***Number juveniles (<100 grams)***	**number snakes seen but not captured**	**total number target species observed**
RATTLESNAKE						
Cowdrop	4	12 Cv	*4*	*8*	3 Cv	15
Stone's Throw	3	8 Cv	*3*	*5*	4 Cv	12
Telegraph	3	14 Cv	*5*	*9*	18 Cv	32
Big Horn	2	5 Cv	*3*	*2*	13 Cv	18
Frederick	4	8 Cv	*7*	*1*	8 Cv	16
Mitch's	2	23 Cv	*13*	*10*	16 Cv	39
Ben's	2	10 Cv	*4*	*6*	6 Cv	16
Basque	2	3 Cv	*3*	*0*	1 Cv	4
Pimple	2	4 Cv, 1 Cc	*0*	*5*	10 Cv	15
City Vista	4	7 Cv, 1Cc	*7 Cv*	*1 Cc*	7 Cv	15
Dry Gully	6	0	*0*	*0*	0	0
Lone Fir	2	1 Cv	*0*	*1*	1 Cv, 1 Cc	3
River View	3	3 Cv	*3*	*0*	3 Cv	6
Railway	0	0	*0*	*0*	0	0
Waterfall	0	0	*0*	*0*	0	0
GOPHER SNAKE						
Hiker's Haven	8	1 Pc	1	0	8 Te, 1 Cc	1
Dry Gully	6	0	0	0	0	0

Two of the three identified gopher snake hibernacula were visited in the spring of 2001. At both of these sites (within the Kamloops area) no new gopher snakes were detected emerging from or in close proximity to the identified hibernating sites. The telemetered gopher snake overwintering at one of these two sites failed to emerge from its underground location, suggesting overwinter mortality. Several garter snakes (*Thamnophis elegans*) and one racer (*Coluber constrictor)* were observed at the other site, along with the emerging telemetered gopher snake (Table 7).

5.0 DISCUSSION

5.1 General

It is difficult to make statements about the abundance of both rattlesnakes and gopher snakes in the study area from two years of data. However, our preliminary, subjective evaluation is that populations of these animals likely have declined substantially in the immediate vicinity of Kamloops. This is not surprising, as populations of rattlesnakes (and other snakes in general) generally do not fare well near urban centres (Reinert and Rupert, 1999). Despite the inherent value of rattlesnakes, their presence close to residential areas poses a threat (particularly to children and pets). Gopher snakes often are mistaken for rattlesnakes and killed (this study, and observations of Conservation Officers). In addition, the snakes are attracted by anthropogenic cover objects, such as concrete blocks and garbage, and also by roads that provide a source of heat (pavement and gravel). This likely contributes to roadkill and mortality through increased contact with humans.

In order to fully assess the status of the rattlesnakes and gopher snakes (as well as the other listed snake species), continuation of several initiatives started in this study will be essential to future management decisions:

- continue to monitor and identify populations still existing near urban areas, and determine what general and site specific steps (if any) can be taken to conserve them,
- continue to monitor and identify 'healthy' populations that do not appear at risk (i.e. those subject to little human interference, or those already protected); these data are required to judge the conservation-priority of other more precarious populations
- develop long-term plans to deal with increasing human development and other pressures

5.2 Public Outreach - was it worth it?

In general, we believe our educational pamphlet and work with the media served to raise the public's awareness of the ecological importance and plight of the snakes in the grassland ecosystem. By encouraging the public to interact with us we were able to address individual concerns and questions, such as advising people on how to prevent their actions from negatively impacting snakes and how to minimize snake/human conflicts in general. People who were indifferent to the plight of rattlesnakes and gopher snakes often were unaware of the snakes' ecological role, their 'blue listed' status, the fact that it is unlawful to kill snakes and in several cases, their actual presence in the Kamloops area. More specifically, people living in or on the periphery of grassland snake habitat often were unaware of the fact that they could very well encounter of one several types of snakes in or near their property. This lack of knowledge combined with an abundance of misinformation are most likely contributing to the needless killing of these and other species of snakes. **A program parallel to the 'Bear Aware' initiative is necessary, particularly in interface areas.**

As indicated in our Results section, our work in this area was very time-consuming. **Although one-on-one conversations were an excellent avenue to increase public education and awareness, we do not feel these were significantly useful methods of obtaining reliable sighting records, especially given the time commitment.** Pamphlet distribution as a means of garnering sightings continued in 2000, but only in areas immediately adjacent to sites that we were targeting (see below). This was slightly more productive and did result in the location of three snakes suitable for radio telemetry. When time and money are limiting, focusing door-to-door surveys and pamphlet distribution on specific areas adjacent to areas with a high potential for snake presence is recommended, versus a 'blanket survey' that includes areas where presence is questionable. Media coverage such as television, newspaper and radio stories were less time consuming and reached a much larger audience. However, the reliability of calls received from this audience still is poor.

We have started discussing the possible expansion of the snake interpretive exhibit at the Kamloops Wildlife Park, and the creation of a BC 'Snake Website', but initiatives such as these are beyond the scope of the present study.

5.3 Distribution

rattlesnakes:

The fact that rattlesnake populations seem lost on the south-side (northward-facing) of the Thompson river is disturbing but not surprising. Bunchgrass (BG) and ponderosa pine (PP) zones appear to be the main habitat for rattlesnakes, and these habitat types are (and were) less extensive on the northward-facing side of the valley. Thus, relatively speaking, habitat and hibernacula may have been scarcer on this side of the valley, and thus the populations were more quickly eradicated. Also, significant development, both residential and industrial, has been present on the south-side of the Thompson River for

at least seventy years. Anecdotal and unsubstantiated reports of rattlesnakes on the south-side of the Thompson River were documented and investigated, but launching large-scale field inventories of this area was considered too time-consuming based on the small number and questionable reliability of reports from this area. As mentioned earlier, we felt it was more prudent to target areas where there is at least some indication that rattlesnakes still exist.

We found rattlesnakes in the Bunch grass and Ponderosa Pine portions of the THB ecosection. Sighting reports and a previous study (Freeman 1998) indicate that the range of rattlesnakes in the Thompson-Nicola includes portions of the Pavillion Ranges (PAR) and Southern Thompson Upland (STU) ecosection as well.

gopher snakes:

There are two main problems in trying to assess the abundance of gopher snakes in this area. The first is that although **we encountered comparatively fewer gopher snakes in the field, this does not necessarily indicate that these animals are less abundant than say, rattlesnakes.** It may be possible that gopher snakes simply are more difficult to locate in the field. Our telemetry data supports Shewchuk's (1996) observations that gopher snakes are fairly mobile, whereas rattlesnakes tend to position themselves in one location for relatively longer periods of time often in close association with a cover object (this study and others). The gopher snakes with transmitters were observed using rodent holes as a source of cover on many occasions, Shewchuk (1996) also found that gopher snakes in the Okanagan would seek refuge underground. This makes visual detection of the snakes much more difficult. The second problem is that Western Terrestrial Garter Snakes frequently are mistaken for gopher snakes (and sometimes rattlesnakes), and this means that unsubstantiated reports of these snakes by anyone other than well-trained and experienced people should not be considered reliable. Still, it is safe to say that sightings of gopher snakes generally are not unusual within the city limit of Kamloops, particularly in 'green belt' areas, on both sides of the Thompson River. In more general terms, gopher snakes only were observed and captured in the Bunch grass and Ponderosa Pine subzones of the THB ecosection, although there is some suggestion that that animals may occasionally be found in the PAR and STU ecosections.

5.4 Use of Cover Objects

***rattlesnakes*:**
The results of our field surveys in combination with our telemetry data indicate that rattlesnakes generally are associated with cover objects. A study by Macartney (1985) found a similar relationship to cover objects. Rocks were the most common cover object used by rattlesnakes. The snakes often were observed basking beside or slightly underneath rocks, where if disturbed they were able to quickly move to safety, usually into an opening beneath the rock.

The fact that some of our rattlesnakes spent a considerable amount of time immediately next to roads is disconcerting, and it would seem desirable to prevent rattlesnakes (and other snakes) from associating themselves with road-side structures. **Ensuring that road-side concrete berms are fully sealed may prevent snakes from using them.** However, rodent burrows under these berms still may provide access to the snakes. As a result of our work, the Kamloops Naturalist Club and BC Parks are now collaborating to determine how to seal the holes in concrete berms found within Lac du Bois provincial park. Concrete berms also are found in many other locations and initiatives to seal the holes in these berms should be considered as well. Garbage and other discarded objects also are often found near roadsides and residential areas, rattlesnakes were observed using objects such as discarded boards and concrete for cover. Although these objects may be benefiting the snakes by providing cover they could also be perceived as a detriment due to the fact that they may be attracting snakes to areas where humans frequent.

Conversely, the placement of cover objects *away* from sources of mortality (like roads), might provide a means of monitoring animals. Although we did not find any snakes using our plywood 'cover objects' during this study, the poor results could be a function of the timing and weather, and the fact we did not check the boards on a regular basis. In addition, it may take several years for the snakes to learn the location of the objects. If our monitoring indicates increased use of these boards over the next couple of years, one may start considering options for using these to index snake abundance.

gopher snakes:

Radio telemetry indicates that gopher snakes primarily seek out rodent holes for cover. While rattlesnakes mostly were associated with rock, gopher snakes were usually underground. This difference may be explained by the fact that rattlesnakes usually were found in areas that had significant amounts of rock while gopher snakes were found in open sagebrush grasslands where few rocks are present. Gopher snakes were observed in and around piles of miscellaneous human refuse, including torn bags of household garbage. Again, although these objects are providing cover their presence may in fact be attracting and keeping the snakes in areas where the probability of human-snake encounters are most likely higher.

comparing rattlesnakes and gopher snakes:

In general, rattlesnakes used rock formations more often than gopher snakes. One factor most likely contributing to this difference in habitat use between the species is the different hunting strategies that rattlesnakes and gopher snakes use to obtain food (i.e. sit-and-wait versus active hunting). However, another potentially-complicating factor is that generally our rattlesnake data were obtained from the north side of the Thompson and South Thompson Rivers, whereas the gopher snake data principally were collected from the south side of these rivers (where rattlesnakes appear to no longer be present). Ideally, one would want to collect data on both species where they are sympatric, but we had only one site (Walhachin) where that occured. At this one site, there was a tendency for the gopher snake to use woody cover (e.g. sagebrush) more than the

rattlesnake. However, as mentioned, our telemetered gopher snake at this site sometimes shared a cavity under the stump of an old telephone pole with a rattlesnake).

5.5 Conducting an inventory: can we predict when is the best time to look for snakes?

During telemetry, snakes were visible to the investigator over a large range of air temperatures (15-35^{o}C). Extreme weather conditions, such as very warm or cold air temperatures, strong winds and/or precipitation likely can be ameliorated if the cover object that the snake is using provides sufficient shelter. This suggests that although weather plays a role in successfully sighting a snake, the type of cover object and the protection it provides also plays a role. This means it is quite difficult to gauge the best time to search for snakes in different habitats, under different weather conditions. This situation becomes particularly problematic when the time available for searching for snakes is constrained, say by funds or the %%.

In general the habitats where we found gopher snakes were open grasslands with no trees and only sagebrush present as natural cover. Using what we learned during our searches for gopher snakes in 1999, we were able to locate and implant three suitable gopher snakes with transmitters in 2000. As mentioned above, snakes generally could be seen during a fairly wide range of conditions. However, during most of our radio telemetry visits we found it impossible to actually see the gopher snakes; rattlesnakes were conversely more routinely visible to the investigator. This may indicate that the lack of cover objects in the gopher snake habitat is causing them to seek cover underground. We did not attempt to actually quantify cover objects, but this is something that would merit further study.

5.6 Locating hibernacula.

Attempts to locate hibernacula by searching high quality habitat where rattlesnakes and gopher snakes were known to live were not successful. Extensive rock formations make systematic searching for hibernacula too time consuming, and in some cases, too dangerous. However, the combination of a reliable report of an aggregation of snakes and very precise directions allowed us to locate two hibernacula. Overall, our telemetry program proved very effective at locating hibernacula.

6.0 Conclusions and Recommendations

Based on our results, experiences, and lessons-learned, we make the following ten general conclusions and recommendations:

① Rattlesnakes in the Thompson-Nicola region of British Columbia are not in immediate danger of extirpation, but the on-going loss of habitat, coupled with increased contact between people and these animals, makes their situation tenuous. The species should remain on the blue-list for the province ('vulnerable').

② It is very difficult to assess the status of gopher snakes at this point in time, although they also are likely not in immediate danger of extirpation. Compared to rattlesnakes, gopher snakes are more cryptic and mobile, making detection relatively more difficult**. Sightings and reports of these animals other than from people with professional experience with snakes generally are not reliable**, because of frequent confusion with the Western Terrestrial Garter Snake. For the time being, the species should retain it's 'blue-listed' status.

③ Rattlesnake hibernacula in the Thompson-Nicola region show characteristics typical for this species: south-facing rocky outcrops or fissures. Hibernating populations have generally suffered when in close proximity to the city, and continue to do so.

④ We found no evidence of communal gopher snake hibernacula. These snakes do not appear to always hibernate in microsites like that seen in rattlesnakes. Non-descript rodent holes and other small openings may be used. This makes habitat protection for these snakes relatively more difficult, as it likely will be impossible to pinpoint specific locations of hibernacula.

⑤ Developers, land-managers and government agencies must realize that inventory for both rattlesnakes and gopher snakes takes time and money. Unless good, reliable information already exists, **long, extensive and repeated field searches are necessary to decide with any level of confidence that an area does not support rattlesnakes and/or gopher snakes.** Radio-tracking animals encountered during the summer is a very reliable but time-consuming and expensive method of identifying hibernacula. It likely will prove more successful than even intensive searching in rocky areas that appear to afford good conditions for hibernacula.

⑥ Natural cover objects in the grasslands are important to these animals, particularly rattlesnakes. Long-term management plans must recognize this and ensure this component of the grassland ecosystem is not lost. Unfortunately, the role of cover objects such as coarse-woody debris has not received as much attention in grasslands as in, say, thicker forested-habitats.

⑦ Anthropogenic cover objects unintentionally bring snakes into areas where they are relatively more likely to be encountered by humans. In the case of rattlesnakes, this poses a danger to both the snakes and people. Developers, agencies and private citizens should take steps to reduce cover objects, or make cavities under them inaccessible to snakes.

Municipal governments and/or land developers in areas that may contain rattlesnakes should be required to construct snake-proof fences along the periphery, in order to minimize the movements of the animals into the developed area. There likely would be opposition to such a requirement, not simply because of the cost, but because it would make potential buyers realize they are moving into 'rattlesnake habitat'. Still, this situation is similar to the need to raise the awareness and preparation of residents in areas where the threat from wildfire exists, or encounters with large predators are possible. Point ⑤ above also should be taken into consideration when landscaping these areas.

In general, people living in areas that interface with snake habitat are ignorant of the values and threatened status of gopher snakes and rattlesnakes. People in general also are not capable of accurately identifying snakes that they encounter, either in their backyard or in the field. More elaborate education programs are called for, even something akin to the successful 'Bear Aware' program. This initiative would dovetail with the suggestion made in point above.

A long-term monitoring program based around known snake hibernacula needs to be implemented. This is the only means to reliably track rattlesnake populations through time. This does not seem to be a useful method for monitoring gopher snakes because these animals do not appear to den communally in this region.

7. Literature Cited

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Reinert, H.K. and Rupert, R.R. 1999. Impacts of translocation on behavior and survival of timber rattlesnakes, *Crotalus horridus*. J. Herpetol. 33: 45-61.

Shewchuk, C.H. 1996. The natural history of reproduction and movement patterns in the gopher snake (*Pituophis melanoleucus*) in southern British Columbia. MSc thesis, University of Victoria.

INSERT MAP

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APPENDICES

Appendix 1: examples of information pamphlets circulated in 1999 and 2000

Appendix 2: examples of newspaper articles on project

Appendix 3: Habitat Data Form used to record information in the field

APPENDIX 1. 1999 information pamphlet distributed throughout community

RATTLESNAKE, GOPHER SNAKE, AND BADGER SURVEY

Have you seen any of these animals?

The Western Rattlesnake, the Great Basin Gopher snake, and the Badger are species considered vulnerable to habitat loss. At present, there is a lack of knowledge regarding the population size, home range, and denning sites used by these animals in our area. This information is needed to protect these important species and the areas that are vital to their survival.

Killing or capturing these snakes is illegal under B.C.'s Wildlife Act. Rattlesnakes, Gopher snakes, and Badgers are important grassland predators, eating mainly mice and voles. Snakes play a large role in their ecosystems as both predator and prey. By protecting these unique and wonderfully adapted animals we are conserving diversity of life in our province!

How can you help? If you see a rattlesnake or gopher snake, or have any other questions or concerns, please contact us immediately at the **UCC Snake Hotline,**

☎ (250) 371-5945

or the **Badger Hotline** (toll free)

☎ 1-888-BADGER6

In situations where removal of the snake is necessary, researchers will make every effort to respond to calls as quickly as possible, especially in areas of high potential human impact. Roadkilled snakes are also sources of valuable information.

To enable you to better determine the correct identity of a suspected rattesnake or gopher snake, some basic facts and key features of three commonly confused species are included inside.

HAVE YOU SEEN THIS MASKED MAMMAL LATELY ?

American Badger (*Taxidea taxus*)

IF YOU HAVE INFORMATION ON BADGER SIGHTINGS OR DENS

PLEASE CALL OUR TOLL-FREE

BADGER HOTLINE

1-888-B A D G E R 6

(2 2 3 4 3 7 6)

THE THOMPSON / OKANAGAN BADGER PROJECT WOULD GREATLY APPRECIATE YOUR HELP

Research funded in part by the Habitat Conservation Trust Fund (HCTF), and conducted by the University College of the Cariboo and the Ministry of Environment

THE UNIVERSITY COLLEGE OF THE CARIBOO

HABITAT CONSERVATION TRUST FUND

SNAKE HOTLINE (250) 371-5945

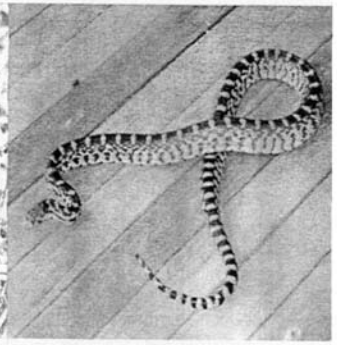
APPENDIX 1 continued. 2000 pamphlet distributed throughout community

RATTLESNAKE & GOPHER SNAKE SURVEY

HOTLINE: 1 – 888 – 816 – 6333

Have you seen these snakes recently?

Western Rattlesnake



Great Basin Gopher Snake

We are most interested in recent sightings but even older sightings are useful. These snakes are blue listed (considered vulnerable to human activities or natural events) in BC. In order to ensure that these species survive throughout their natural range we are gathering information on their distribution, numbers and habitats. Your participation will help to protect these unique animals and the areas that are important to their survival.

BRITISH COLUMBIA CONSERVATION FOUNDATION

FOREST RENEWAL BC

HABITAT CONSERVATION TRUST FUND

British Columbia Ministry of Environment, Lands & Parks

Why are rattlesnakes and gopher snakes at risk?

These snakes have a restricted range in BC's southern interior, so any habitat loss is very significant. They have been persecuted by humans throughout their range and are particularly vulnerable to disturbance at their den sites. Expanding development and continued persecution result in snake populations becoming more at risk.

Why should we protect these snakes?

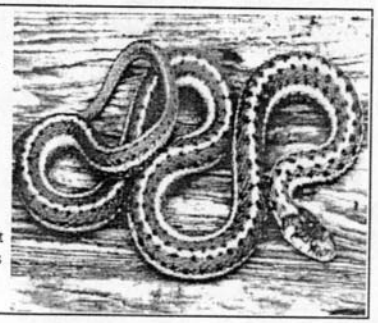
Snakes are a very important part of our grassland ecosystem because they control rodent numbers and help maintain biodiversity.

Killing or capturing any snake is illegal under BC's Wildlife Act.

How can you help?

If you see a rattlesnake or a gopher snake, or have any questions, please contact us immediately. If removal of the snake is necessary, researchers will make every effort to respond to calls as quickly as possible. Road killed snakes are also sources of valuable information.

The Western Terrestrial Garter Snake may be confused with young rattlesnakes and gopher snakes. However, rattlesnakes have rattles and a triangular head, and gopher snakes have distinct rectangular patterns on their back.



APPENDIX 2 : examples of media coverage

UCC STUDY: Rattlesnake, gopher snake sought

Search on for scarce snakes

by ELSBETH DUURTSEMA
This Week Staff

Researchers are seeking out some of the region's scarce snakes.

University College of the Cariboo grad Nadine Bertram and third-year sciences student Dianne Haughland are on the lookout for two vulnerable snake species: the Western rattlesnake and the Great Basin gopher snake.

The goal of the project, being conducted under the leadership of assistant department of natural resource science professor Karl Larsen, is to better understand the snakes needs and begin to protect their crucial habitats.

The habitat data collected will be "dovetailed" with provincial mapping projects, helping to protect special hibernation, nesting and rearing sites in the future.

The project has been underway for a couple of weeks already and a handful of snakes have been located.

Eventually, the researchers plan to capture some of the snakes and surgically implant radio transmitters in them.

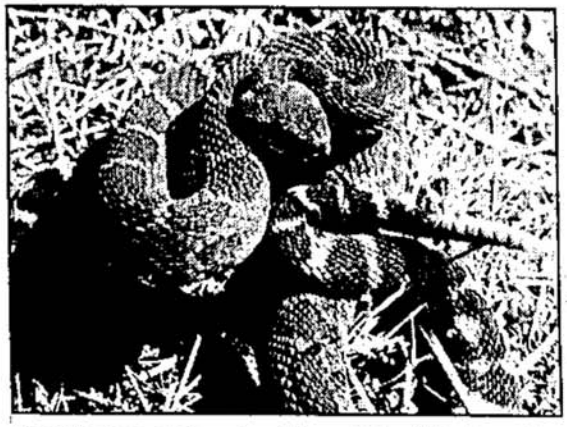
Signals for the beacons, it's hoped, will allow the scientists to follow the snakes to their winter dens.

"Between 30 and 100 snakes could stay in one den, but we really don't know much else about the dens," says Haugland. "If one of the dens is destroyed, that's a lot of loss."

Unable to produce body heat, the cold-blooded critters fail to survive winter unless in a secure den.

Anyone seeing a rattlesnake or gopher snake is invited to call the UCC Snake hotline at 371-5945.

The project is funded by grants from the Habitat Conservation Trust Fund and the Natural Sciences and Engineering Research Council of Canada.



The Western rattlesnake, left, and Great Basin gopher snake are the subject of a UCC project.

Appendix 2 continued

A4 The Daily News, Kamloops FRIDAY, MAY 21, 1999

UCC survey and hotline track vulnerable Interior snake species

By ROBERT FAULKNER
Special to The Daily News

Be on the lookout for snakes, Kamloops.

That's the message from a UCC wildlife ecologist, two students and a wildlife specialist with the Ministry of Environment. Since May 10, the four-person team has scoured local hills for the western rattlesnake and the great basin gopher snake — species that call our dry grasslands home.

"Our goal is fourfold: to upgrade our knowledge on snake distribution, to raise community awareness, to locate hibernacula (dens) and to work out future management concerns," said UCC Natural Resource Science instructor Karl Larsen.

The study aims to correct the current lack of knowledge about the species, a gap that may ultimately cause their decline. The two species are "blue-listed" with the Ministry of Environment. That means they are vulnerable or sensitive to habitat loss and that they play an integral role in the ecosystem, said UCC student Diane Haughland.

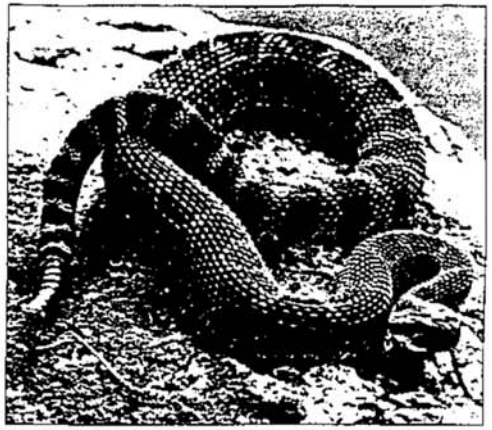
Road construction and housing development are a greater threat to snake habitat than forestry, said Larsen. New roads can isolate snake communities into little islands or bar them from revisiting communal dens.

"But at this point we don't know how seriously they are threatened. They may be as abundant here as in the Okanagan," he said.

The Thompson-Nicola Snake Survey received financing from the Habitat Conservation Trust Fund and from two student awards from the Natural Sciences and Engineering Research Council of Canada.

To gather more information, the survey maintains the UCC Snake Hotline at (250) 371-5945.

"We are interested in any snake sighting, even road kills" said student Nadine Bertram. "We hope people will call us instead of killing snakes. We will come over right away."



THE VENOMOUS western rattlesnake is one of British Columbia's largest vipers. It is sometimes found in rocky outcroppings in the hills of the Interior drybelt.

The snake search is on

Kamloops researchers are searching for Rattlesnakes and Gopher snakes (known locally as Bull Snakes) here in the Ashcroft and Cache Creek area.

John Surgenor, the Rare and Endangered Species Specialist with the Kamloops Ministry of Environment supervises a crew of dedicated field researchers to determine rattlesnake and gopher snake distribution and promote awareness in our area.

The Western Rattlesnake and the Great Basin Gopher Snake are 'blue-listed', which means that they are considered vulnerable to human activities or natural events. This, coupled with their restricted range in BC's southern interior, puts these animals at considerable risk.

Nadine Bertram, a recent Natural Resource Science Degree graduate, Stephanie Chaput, Chris Thevarge and Lita Gomez, University College of the Cariboo students are working for the British Columbia Conservation Foundation in an attempt to identify the critical habitat of these two unique animals.

One goal of the project is to locate rattlesnake and gopher snake den sites. With the assistance of a veterinarian, select snakes are implanted with small radio-transmitters allowing the researchers to follow the snakes' movements. Since snakes return faithfully to the same den site year after year, these sites are particularly vulnerable to human disturbance and deserve special attention. Once the snakes' critical habitat has been located, this information can be used when considering future land management.

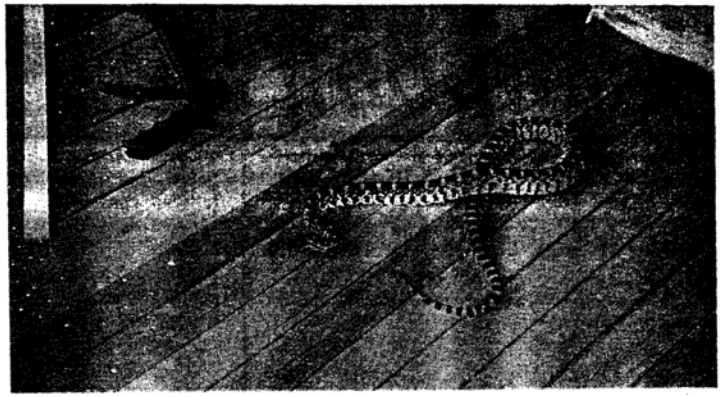
In addition to manually scouring the hills for snakes, the researchers have implemented a Snake Hotline to increase the number of threatened snakes found. "We rely heavily on sightings from the public", says Bertram. Hotline calls currently have resulted in the capture of four snakes suitable for transmitter implantation in the Kamloops area alone.

Rattlesnakes can be identified by their triangular shaped head and rattle at the end of their tail while gopher snakes have a distinct rectangular pattern on their back.

If anyone has seen a rattlesnake or gopher snake recently or have any questions, they are asked to call 1-888-816-6333 toll-free.

Rattlesnakes are the only venomous snake species in British Columbia. According to Chaput, there is no need to fear or hate snakes, but it is important to be aware of the potential danger of some species and to follow some simple precautions when in rattlesnake country. Avoid putting hands and feet in cracks and holes, be careful when turning over logs, rocks and other large objects under which snakes could be hiding, and always wear pants and closed shoes. If you come across a rattlesnake, maintain a safe distance of at least 3 meters (10 feet). Snakes do not pursue people; however, they might strike if they feel threatened.

Funding for the project has been provided by Student Summer Works, the Habitat Conservation Trust Fund, British Columbia Ministry of Environment, Lands & Parks and Forest Renewal BC.



Great Basin Gopher Snake

This Great Basin Gopher Snake, known locally as the Bull Snake,was captured under the porch of an abandoned house in Walhachin for tagging with a small radio transmitter , by the researchers, so that its movements can be tracked and its habitat and den recorded. The snakes are 'blue listed' meaning they are vulnerable to human activity or natural events.

Rattlesnake

The Rattlesnake which is found in some areas locally is also being studied by the researchers and are being captured and having a small radio transmitter placed on them to track their movements and locate their dens. In the photo at right Nadine Bertram is shown using the radio-telemetry equipment to follow one of the tagged snakes near

Appendix 2 continued

Scientists unrattled by snake research

Twelve rattlesnakes equipped with radio transmitters in Kamloops

SHKSHKSHK! That's the sound of a rattlesnake's warning rattle.

The heart-pumping sound might stop some dead in their tracks, but not the hardy researchers combing the Kamloops grasslands for this endangered species.

A study aimed at learning more about the snakes – The Identification of Critical Habitats for the Western Rattlesnake and Great Basin Gopher Snake in the Thompson-Nicola Region of B.C. – finished last fall.

"We didn't know much about the snakes in this area," said John Surgenor, rare and endangered species specialist for the B.C. Ministry of Environment.

The program, which started in 1999, exchanged information with the public. The "snake crew," who did the fieldwork, informed the public by handing out pamphlets, talking at schools, and requesting that any snake sightings in the community be reported.

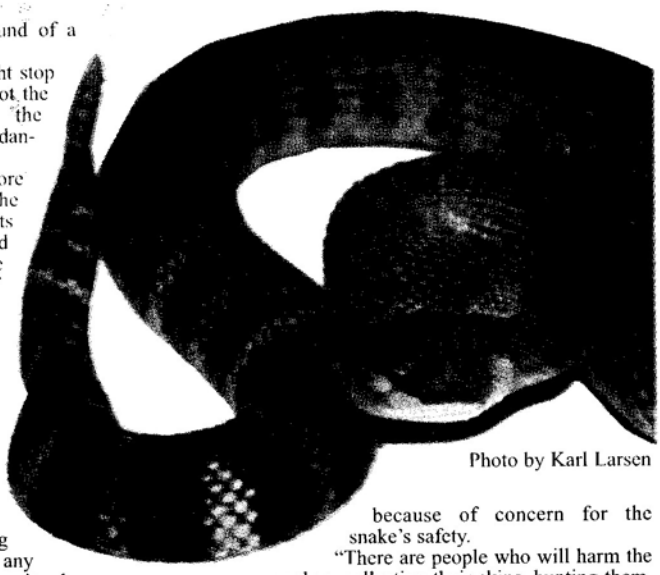


Photo by Karl Larsen

Radio transmitters were the main tool of the study, which involves catching wild snakes.

"It was a lot of hunting. It took an average of 8.4 hours of searching for each snake captured," said Karl Larsen, natural resource science professor at the University College of the Cariboo.

By Erin Mills

In the program's two years, 12 rattlesnakes and three gopher snakes were captured and had radio transmitters implanted in their lower abdomen.

"We tracked the range and distance they traveled but, most importantly, we were able to track them to their fall dens," said Larsen.

The study located 16 den sites. Although the number of snakes in each den is not yet known, the study did give some indication of snake population and habitat.

"No one had studied the snakes or identified hibernation dens before," said Nadine Bertram, a lead member of the "snake crew."

The specific den locations will not be released because of concern for the snake's safety.

"There are people who will harm the snakes, collecting their skins, hunting them, or whatever they do," said Surgenor.

The study also collected information on habitat features, natural travel patterns and causes of death, including those killed by humans.

"People kill snakes for no reason other than fear and ignorance," said Larsen. "Who knows how many are killed that we don't know about."

"Some people kill snakes just for the head and rattle, which they sell. Basically, it's poaching and illegal under the Wildlife Act of B.C.," said Bertram.

"Some people believe snakes aren't worth anything, but it's because they don't understand them," said Bertram. "They think snakes are out to get them, trying to bite them."

"Snakes are people shy. Just leave snakes alone and they will leave you alone," said Surgenor.

"They are a key player in the ecosystem both as predator and prey," said Bertram.

The burrowing owl, another of B.C.'s endangered species, once used old snake dens as its home. Juvenile burrowing owls will imitate the sound of a rattler to keep predators away.

"The study essentially gave us an idea of what might be an area of concern. There is now potential for long-term monitoring," Larsen said.

"There is opportunity for future research," said Bertram.

For now, the study is the first step in protecting the snakes some day.

Grasslands, UCC stuent newspaper

Appendix 3. Form used to record habitat data from snakes located in the field

HABITAT DATA FORM **Frequency:**_____

General Location_____ Snake Activity_____ Visual / Auditory / NA

Date_____Time_____ Species_____ Map #_____

Slope_____ Aspect_____ Mesoslope Position_____

Percent Cover: Trees_____ Shrubs_____ Herbs_____ Rocks_____

CWD_____ Rock Features_____

Air temp. _____ Ground temp. _____Cloud Cover_____ Wind_____Precip. _____

Significant Landscape Features (water, buildings)